OCTOBER 1954

Industry & Welding

METAL SHOW ISSUE

36th Annual Metal Congress & Exposition

35th Annual Meeting of the American Welding Society

SAVE THIS ISSUE . . .
It Contains Valuable Reference Data on Welding and Brazing of a Wide Variety of Metals.

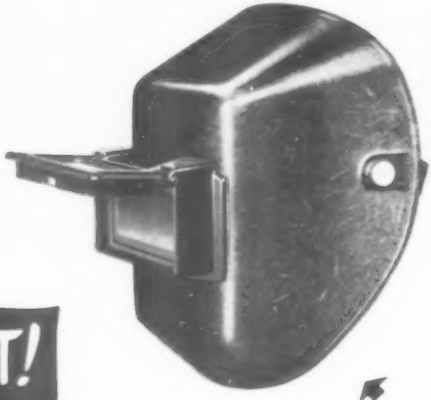
HOW TO JOIN . . .

ALUMINUM
MAGNESIUM
CAST IRON
DISSIMILAR METALS
TITANIUM
TANTALUM
LOW CARBON STEEL
STAINLESS STEEL
COPPER

FRANCHISE CIRCULATION

CIRCULATION THIS ISSUE 36,226

FIXED-FRONT HELMET type H-3
has light metal lens holder. Cover glass is replaced from the front by sliding it out without disturbing other parts.



Another Jackson FIRST!

Two Helmets in Popular Narrow-Front Style Now Made in Modern Fiber-Glass Plastic

For the first time, Jackson offers two welding helmets in the popular shape favored by many weldors to make work easier in the tight spots. Type H-3, with fixed front, and H-4, with lift front are otherwise similar to the other Jackson Helmets, but somewhat lighter in weight.

Helmets H-1 and H-2 have long since proved the economy of long-lived fiber-glass over vulcanized fiber. More resistant to heat and moisture, they hold their shape, withstand weld spatter and high voltage, are strong, smooth, easy to clean, and attractive in appearance.

Headgears are of smooth plastic, easy to clean, with inexpensive, snap-on, cork-padded sweatband. Calibrated to hat sizes in ½-inch steps, they are quickly fitted. Friction pivots are adjustable by hand while helmet is worn. Helmets can thus be made to float down without jolts, and stay in any desired position.

LIFT-FRONT HELMET type H-4
permits work inspection without raising the entire helmet. The lens holder is of high-impact thermosetting plastic with hinged door held up or down by coil springs. Filter lens is protected by a cover glass, and a second clear glass stays in place when front is up to protect the eyes from flying particles.

type H-2

type H-1

QUALITY JACKSON PRODUCTS

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Sold World Wide . . . through Distributors and Dealers

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Go COMPLETELY Automatic!

Put HOBART POWROMATIC WELDERS

and Conversion Kits to work for you at once!

With a Hobart *Powromatic* welder and conversion kit you can improve your present continuous wire feed welding operations to the point where you can really call them automatic.

The *Hobart Powromatic* welder is designed to maintain a constant arc voltage at a preset value. Once the type and size of wire is established and correct arc voltage is determined, the amount of current to the arc is automatically adjusted by *Powromatic* to suit the speed of the wire feed. In doing this a simple conversion kit does away with the complicated mechanisms you now use.

Powromatic Welders are available in 400-600 and 900 amp. sizes.

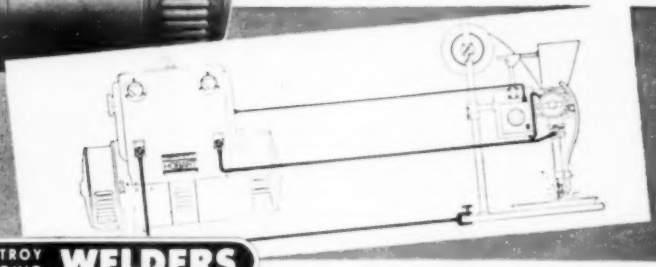

Diagram shows extreme simplicity of control when adapter kit is installed.

HOBART TROY OHIO **WELDERS**

Contact your nearest Hobart Distributor or return this coupon for further information.

No Obligation!

HOBART BROTHERS CO., BOX HW-104, TROY, OHIO

"One of the world's largest builders of Arc Welders"

To Hobart Brothers Co., Box HW-104, Troy, Ohio, Ph. 21223

Please have your representative call and give us complete details on *Powromatic* welders and conversion kits. No obligation.

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See this revolutionary welding advancement in Space 365, National Metal Congress and Exposition, Chicago, Illinois, Nov. 1-5, 1954

NEW, REVOLUTIONARY

METALLIZING GUN

Be sure to visit our Booth No. 1456, at the National Metal Exposition, International Amphitheater, Chicago, November 1 through November 5.

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Turbo-Jet

The Result of over 30 Years of Experience

The Mogul Turbo-Jet will spray and deposit an extremely dense coating using wires from 20 ga. to 3/16" dia. from the highest melting point molybdenum to the softest metals. No changing of worm gears or feed rolls.

New Mogul Turbo-Jet is magnetic-controlled, with a spray range from 2½ inches per minute to 20 feet per minute.

Dual feed rolls individually driven, eliminate slippage and give more positive feed.

Will operate on acetylene, propane or natural gas 15 lbs. P. S. I.—low gas and oxygen consumption.

General purpose gun to take care of all your spraying applications.

Write for further information today on the New Mogul Turbo-Jet. Ask about free trial test offer to Metallizing users.

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METALLIZING COMPANY *of America*
Dept. IW

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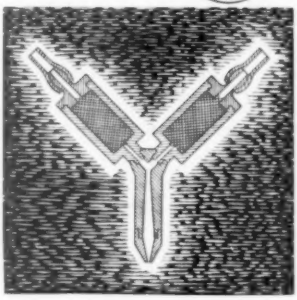
THE STANDARD of WELDERS SINCE 1918!

WELD IT WITH WELDIT EQUIPMENT SUPPLIES

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER



Welders throughout the world have accepted Weldit welding equipment as a standard of quality for over 35 years. Weldit equipment will do a better job faster and at less cost to you. When it's Weldit, it's *welded!*

HISTORY OF WELDING

In the year 1900 a fairly successful method of welding was developed by Edmond Fouche of Paris. In collaboration with Picard, he invented the first practical oxy-acetylene torch illustrated above.

THE WELDIT HEATERAMA SALAMANDER

The new Weldit L-P Portable Heaterama Salamander. Gives high heat at low cost. No priming or pumping, no smoke or soot, positive control, fast, portable and rugged. Priced right and available in either Tank Top or Floor Models. Write for complete technical information.

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Weldit INC. SINCE 1918

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CURRENTLY ANEMIC?

Many companies supply top quality arc welding machines and top quality electrodes to do a top welding job but miss one extremely important point . . .

. . . The performance in the arc is *entirely dependent* upon the cables and accessories that bring the welding current to the electrode from the machine's terminals.

Is your arc current *starved* due to poor connections at lugs, quick connectors, grounds and in holders?

Do your operators have to stop occasionally to cool off electrode holders due to *hot handles* caused by poor connections or use *two holders* where one should do the job?

Does your weld quality suffer due to volt and amperage variations during the welding cycle?

You can eliminate these troubles. Just specify CADDY Accessories and cable splices using 100% solid copper CAD-WELD connections throughout.

CADDY alone gives you a 100% Copper Circuit from the power line through the welding machines *right* to the electrode.

CADDY®

ARC WELDING ACCESSORY DIV.
ERICO PRODUCTS, INC.
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Industry & Welding

OCTOBER, 1954
VOL. 27 No. 10

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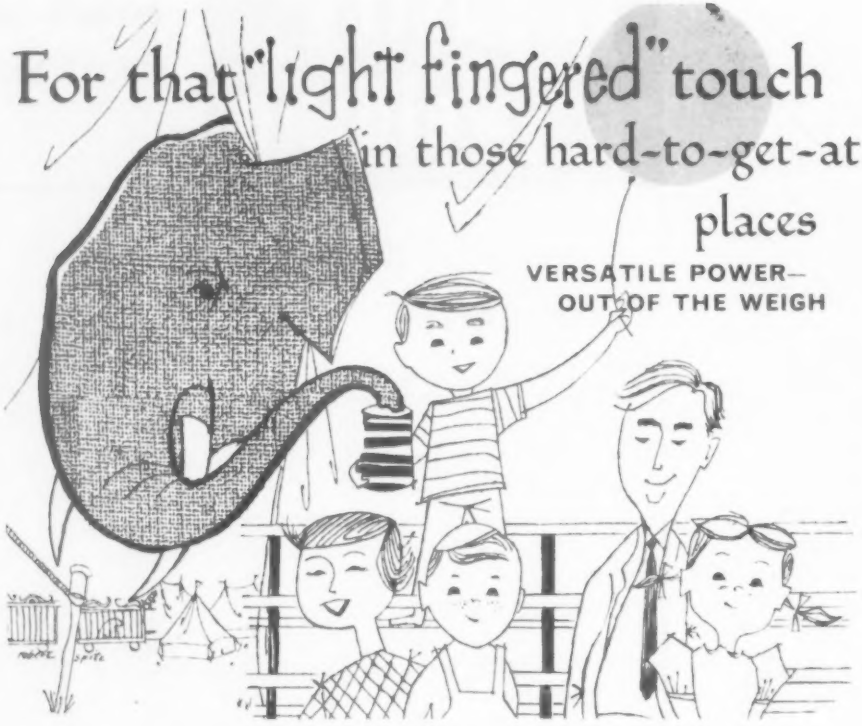
For that "light fingered" touch

in those hard-to-get-at places

VERSATILE POWER—
OUT OF THE WEIGH



Power with the light-fingered touch—for those hard-to-get-at places! Haskins Flexible Shaft Equipment lets the power do the job without burdening skilled hands with heavy motors. For every job of grinding, sanding, filing, polishing or buffing—from $\frac{1}{4}$ HP to 2 HP—Haskins tools increase production and cut costs. Two good reasons why you should write for the latest Haskins Catalog.

The Haskins line provides a wide variety of models with drives, horsepowers, speeds, tools and attachments—including the one assembly exactly suited for your particular job

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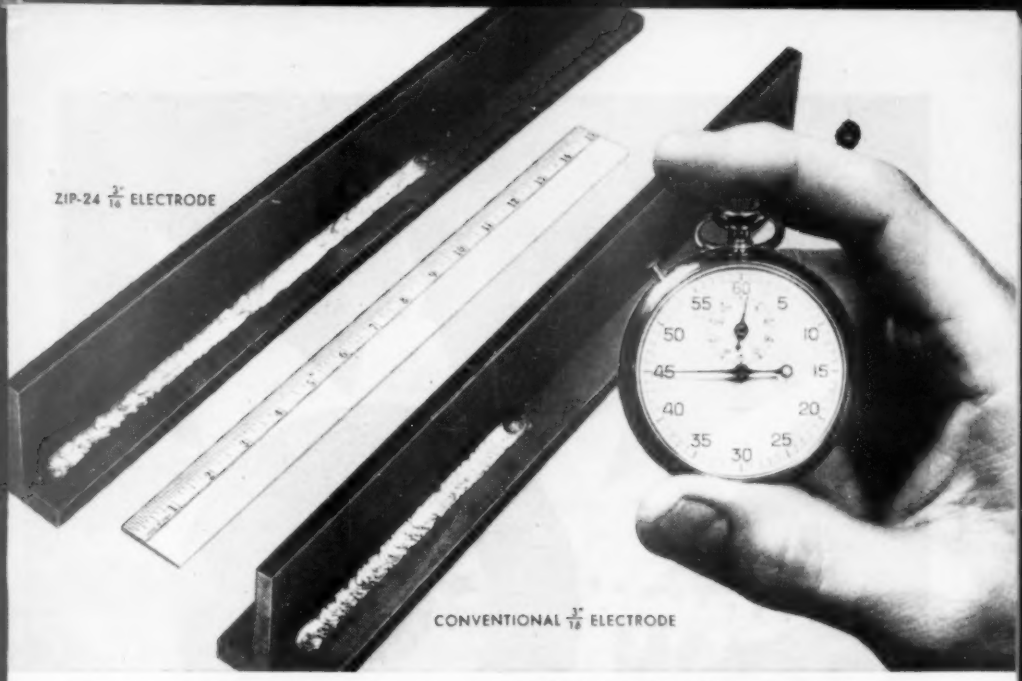

New Westinghouse ZIP-24 Electrode welds twice as fast—better, easier, too

The greatest advancement in mild steel welding electrodes in years. That's what Westinghouse research, plus years of experience as an actual user of welding processes, has made the new ZIP-24. It now gives you a greater combination of plus features than any other powdered iron electrode. For example:

FASTER WELDS—*50 to 70%* greater deposit rates. And an increase of *30 to 50%* in footage of fillet or lap weld per minute.

BETTER WELDS—balanced fillets give appearance of "machined finish" . . . no undercut with fillet and lap welds... perfect wall wash-up . . . easier slag removal . . . minimum spatter loss that reduces cleaning time. And if that's not enough...

EASIER WELDS—even-edged, smooth, finely rippled weld beads even when handled by an inexperienced operator. It's ideal for "drag" technique . . . gives greater flexibility in weld types . . . can be used with either a-c or d-c. And it's available now for . . .

IMMEDIATE DELIVERY—made possible with the opening of our second electrode plant . . . a brand-new Westinghouse Electrode Plant at Montevallo, Alabama.

J-21859-A

Learn more about the new ZIP-24 electrode!

YOU CAN BE **SURE**... IF IT'S

Westinghouse

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Welding Dept., P. O. Box 868, Pittsburgh, Pa.

Please send me a copy of your new folder on the ZIP-24 electrode (B-6389).

☐ Send me free samples of the new ZIP-24 electrode.

☐ Send me literature on the complete line of Westinghouse Electrodes (B-6070).

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Specially treated Nylon Mesh
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Fibreglass to support area around hole and hub

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ANYONE CAN DO A BETTER JOB WITH Mid-States HEAVY-DUTY WELDERS

Mid-States Model 310, 7-300 amps. with Model 13-D "Missing Link"

Even operators with a minimum of experience can do a real workmanlike job with Mid-States Simplified Welding. Mid-States welders provide automatic arc starting, instant amperage changes, and 100% penetration. Virtually adjust themselves to the job! Instant starting speeds up production and eliminates burn-through when welding light metals. 100% penetration assures a stronger, smoother weld that requires only a minimum of cleaning and grinding.

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NOW YOUR PRESENT WELDER CAN DO INERT GAS SHIELDED WELDING . . .

JUST ADD THE MID-STATES "MISSING LINK" AUTOMATIC ARC STABILIZER . . .

Add the Model 13-D "Missing Link" and you've got the benefits of inert gas shielded arc welding at sensationally low-cost. Model 13-D is easily attached to any AC welder of 0-300 amps. For AC welders 300-600 amps., and DC welders, other models are available. This compact unit includes a high frequency generating circuit and solenoid valves to control flow of inert gas and water. The entire unit is controlled through a finger tip switch mounted on the welding torch.

Model 13-D "Missing Link"

WRITE TODAY for complete information on Heavy Duty Mid-States Welder and the Model 13-D "Missing Link" for inert gas shielded welding.

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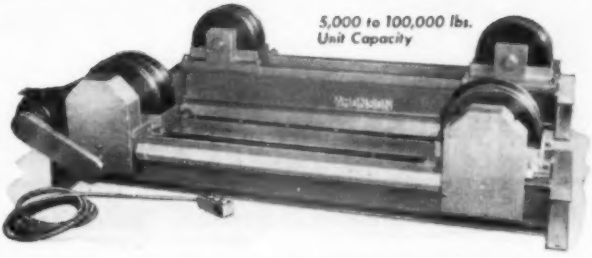
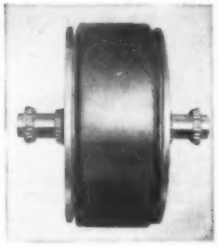


5,000 to 100,000 lbs. Unit Capacity

Any Tank or Cylinder will be somewhat out-of-round and will not be straight, but will have a belly or bend in its average centerline axis. In the case of non-rigid cylinders, multiple rolls are used to hold a true centerline, ironing out the belly or bend. When working rigid tanks and cylinders, it is best to have one roll at each end so as to avoid the belly placing all the load on the middle roll when that belly is down, and all the load on the two end rolls when the belly is up. It is to allow for the average amount of out of-round and belly in cylindrical workpieces that ARONSON has stressed all units for 100% overload Protection. Momentary overloads as high as 100% will not breakdown an Aronson Roll.



Overloading or accidentally dropping the load on an Aronson Turning Roll WILL NOT crush and ruin the tire. The Overload Disc of steel placed on each side of each tire is smaller than the tire by just that amount which allows a safe deformation (flattening) of the tire which occurs at maximum load. Compression and tension Tie-Rods hold the Overload Discs firmly against the steel rim of the rubber tire, forming an effective axle as large in diameter as the O.D. of the steel tire rim. Crushing the tire is impossible regardless of the load put on an Aronson Turning Roll. Large Timken Bearings maintain perfect alignment.

AVOID DAMAGE LIKE THIS

Courtesy of the Rubber Manufacturers Assoc., Inc.

UNDERCUTTING CAUSED BY OVERLOADS

Continuous overloads on this tire caused the rubber to bulge out over the steel bond. This, in turn, set up a shearing or cutting action in the tread. Tire is ripped around the bond on both sides and is about ready to fall off.

Send for Specification Brochure

VISIT OUR BOOTH 2354 AT THE
NATIONAL METAL EXPOSITION IN CHICAGO, NOV. 1-5

Aronson MACHINE COMPANY
ARCADE, NEW YORK

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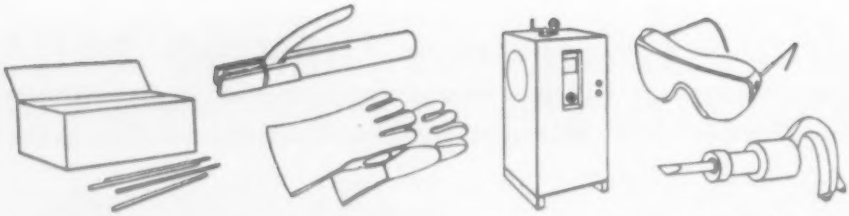


new products

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

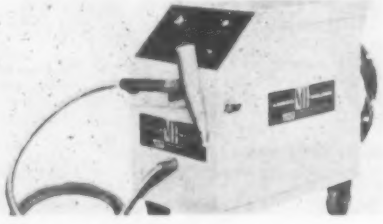
Improved Hardfacing Electrodes

New series of general service iron-base D.C. hardfacing electrodes having a new metallic coating that provides improved weldability and arc stability is now available from Wall Colmonoy Corp. The electrodes provide dense deposits that do not require cleaning or slag removal by chipping or brushing before welding on successive deposits. The welds have uniform hardness and provide improved impact and abrasive resistance over former iron base alloy electrodes.

Circle No. 155 on Reader Service Card.

Welder Uses New Principle

A new, semi-automatic welding machine, being field tested by the Amsco Division of American Brake Shoe Co. combines the advantages of hand welding and automatic welding, while eliminating most disadvantages encountered with either method. The new welding

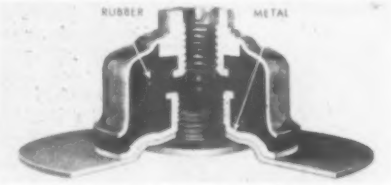


machine feeds bare wire through a hand-held hopper containing magnetic flux. Flux clings to the wire as it leaves the hopper because of the magnetic field set up by welding current flowing through the wire, thus the electrode wire reaches the arc with a flux covering.

Circle No. 156 on Reader Service Card.

Solve Grinding Problems

Consisting of two or three metal parts, impregnated and bonded together by



specially developed rubber core, J & H Company vibration dampener makes it possible to apply full face contact of abrasive discs or wheels without objectionable vibration, bounce or torque and at the same time increase speed of operation and quality of work. Action of unit will eliminate scoring, digging, burning and grooving.

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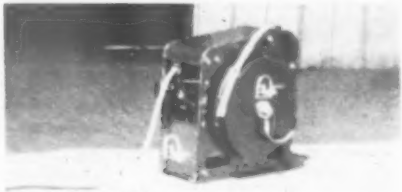
Reel for Welding Hose

New large model reel will store and dispense up to 150-feet of 5/16 twin



welding hose. Introduced by United Specialty Corp., unit is of simple sturdy construction and has no complicated mechanisms which must be adjusted.

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(Continued on Page 140)

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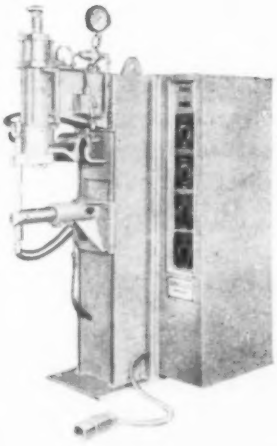
FOR THE FIRST TIME A COMPLETELY NEW DESIGN OF SMALL, LOW PRICE SCIAKY WELDERS

Featuring all the Ruggedness, Dependability and Consistency of Operation Common to Sciaky Basic Thinking—Welders Designed to Do More Useful Work at Lower Operating Cost with Maximum Reliability!



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Through advanced design, mass production tooling, and complete use of integrated parts, Sciaky is introducing a complete new line of standard spot and projection welders. Check these important features . . .

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GRINDING WHEEL INSTITUTE MEMBER

RM-437-R

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Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

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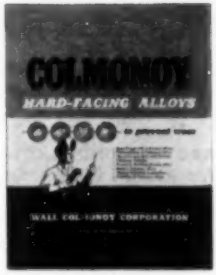
With the right COLMONOY oxy-acetylene rod or electrode for every type of hard-facing application, you'll do all your hard-facing better, quicker and at less cost.

COLMONOY nickel-base rods and electrodes are the easiest of all makes to apply, require less gas and current, and offer the highest resistance to corrosion, abrasion, and high heat.

COLMONOY iron-base rods and electrodes are high in abrasion and impact resistance, low in cost. They are also easy to apply.



Ask for COLMONOY Manual 77 to get all the facts. It gives the physical properties, qualities and uses of all COLMONOY alloys. Learn, too, about the Sprayweld Process, Sweat-on Paste, and wear-resistant castings.

HARD-FACING ALLOYS

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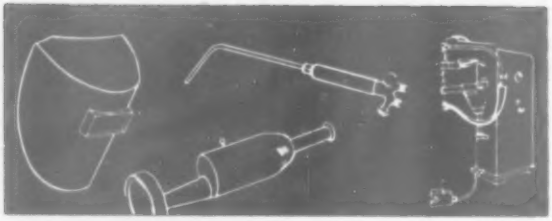

advertisers product index

This "Equipment Index", compiled for easy reference, represents only those advertisers **in this issue** whose product information was available prior to our closing date. All of our advertisers, however, are prepared to supply you with full particulars regarding their equipment, services and materials necessary to most effectively carry out your welding program.

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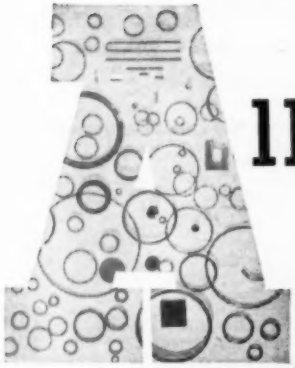
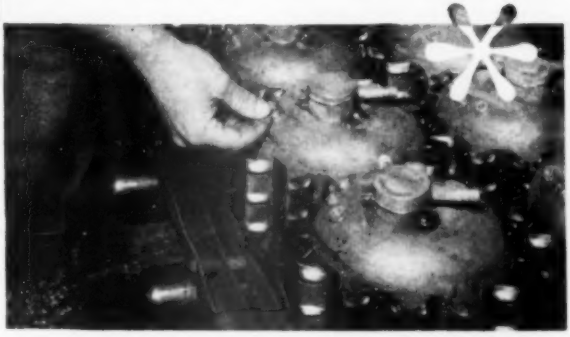


Alloy Rings

cut Brazing Rejects to less than 1% in Refrigerator Compressor Dome Assembly



* Actual photo of refrigerator plant production line where 11 joints are brazed on one assembly with less than 1% rejected under Underwriter's pressure test of 1500 lbs. per sq. in.

Alloy brazing materials insure a perfect job every time . . . consistently uniform, trouble-free brazing with no rejects . . . no reworking!

No question about it—Production Brazing with Alloy Rings is the practical answer to many expensive metal joining problems. Investigate . . . production brazing can help you conquer those sky-high production costs.

Precision is of the utmost importance in successful brazing.

For infallible results insist on precision-made Alloy Rings. Special Alloy packaging methods speed production and cut waste to a minimum.

Write for full information on brazing rings, preformed shapes, silver alloy, copper, soft solder and flux.

Alloy RINGS

ALLOY RING SERVICE, INC. • 1087 EAST 52ND STREET • INDIANAPOLIS 5, INDIANA

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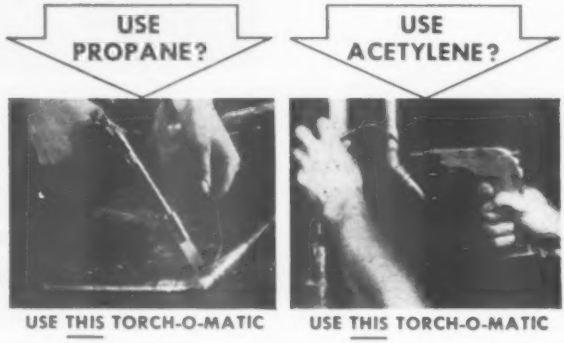
Whichever Torch-o-matic you use— exclusive trigger-control saves you time, saves you fuel!



USE THIS TORCH-O-MATIC

USE THIS TORCH-O-MATIC

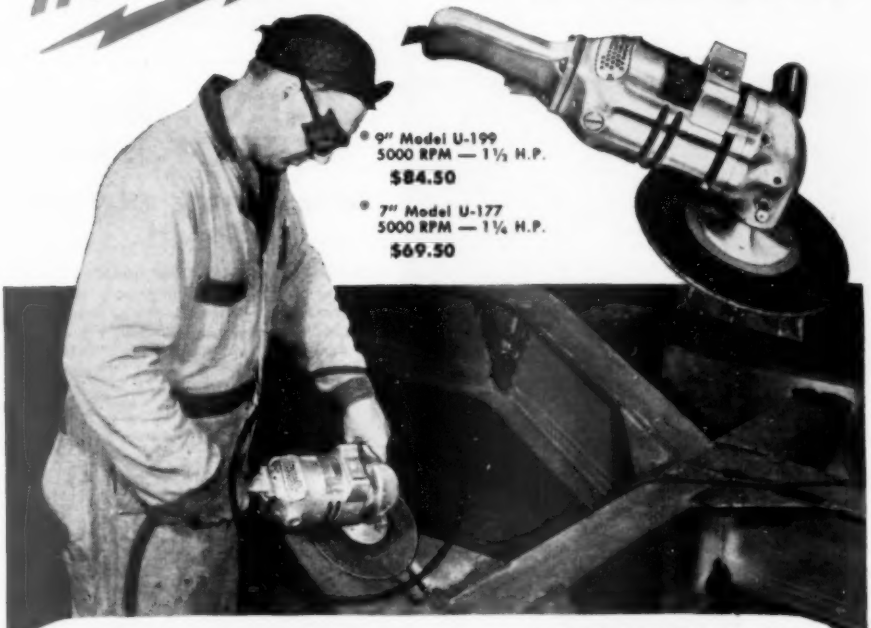
With either the Propane or Acetylene Torch-o-matic, you get the *exclusive* trigger-control feature that *eliminates* lighting-up, adjusting, and open-flame hazards. Just pull the trigger and it lights; release the trigger, it's out! With the Propane Torch, pulling the trigger completely back lengthens the flame from a pin-point to a full 6-inches. This *automatic* on-off flame control saves you time when you're using Torch-o-matic; saves you gas when you're not! Write for complete details on either or both Torch-o-matics.

VELOCITY POWER TOOL COMPANY 201 North Braddock Avenue Pittsburgh 8, Pa.

Circle No. 16 on Reader Service Card.

UNMATCHED...

Milwaukee Clutch-Drive GRINDERS



* 9" Model U-199
5000 RPM — 1½ H.P.
$84.50

* 7" Model U-177
5000 RPM — 1¼ H.P.
$69.50

The EXCLUSIVE free-wheeling clutch drive completely absorbs back-lash shock of heavy and unbalanced grinding wheels. RESULT — Greatly reduced gear wear... quieter, smoother grinding . . . and more years of tool service-life.

Many welding contractors and industrial plants have standardized on MILWAUKEE Clutch-Drive Grinders. Hundreds of these grinders are used in the various Atomic Energy Plants throughout the nation.

LOOK FOR THESE FEATURES:

1. Powerful, Milwaukee-Built, 1½ H.P. Heavy-duty Motor.
2. Cyclonic Type Cooling System . . . maintains temperatures that assure peak operating efficiency under full load . . . keeps work area free of dust and grit.
3. Ball and Roller bearings throughout.
4. Clean functional design makes possible lighter weight, better balance, easier maneuverability.
5. Button-type spindle lock for easy attachment and removal of grinding wheels and discs.
6. Interchangeable side-handle.
7. Heavy-duty, spring-loaded, trigger-type, safety starting switch . . . lockable for continuous running.

Write Today for FREE FOLDER SP-2

MILWAUKEE ELECTRIC TOOL CORPORATION

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NEW 150' WELDREEL

Welding Hose Reel

Now you can store and handle 150 feet of double welding hose on a Weldreel — with the new Model OAB. The new big reel gives you all the safety and convenience of the 50-foot Model OA and, like the smaller model, is ruggedly built to stand up for years under heavy industrial use.

ELIMINATES HAZARDS TO SAFETY — prevents tangles of hose on the floor, cause of many industrial accidents. Permits welder to reel out only as much hose as he needs.

MAKES HOSE LAST LONGER — Reduces chances of hose being run over, cut in two or set on fire by a hot electrode. Users of the Weldreel report three to five times greater hose life.

EASY TO INSTALL ANYWHERE — Simple mounting permits installation in any position, on floors, walls, ceilings or on mobile equipment. Requires only 11" x 24" space.

CONVENIENT TO USE — Keeps hose in a handy location where it may be used alternately by two or more welders. Hose pays out freely and locks automatically at desired length. A slight tug releases lock, allowing the powerful spring to rewind hose onto reel.

See the Weldreel at your supply house or write us direct for descriptive literature

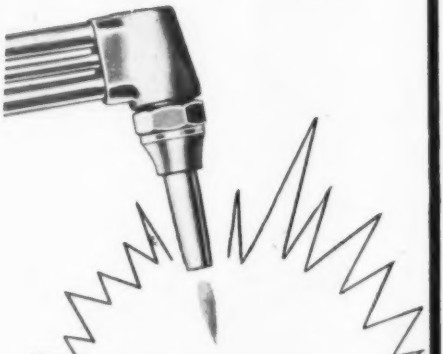
WELDREEL

UNITED SPECIALTY CORPORATION
P. O. BOX 698
EL DORADO, ARKANSAS

Circle No. 18 on Reader Service Card.

Ask Your K-G Distributor to Demonstrate These Two Amazing Products

STOP Discarding Damaged Cutting Tips



Get the torch with a "TIP REPAIR SHOP" *Right in its Head!*

K-G M38 CUTTING TORCH

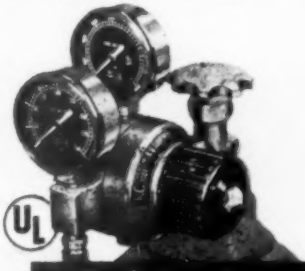
In roughest service, absolutely impervious to flashback!

Even SAND Won't Stop Them!

Since oil and oxygen don't mix

Let Your K-G Distributor Make This Demonstration

Amazing filter action keeps out foreign matter — the basic cause of *seat failure*. Operate perfectly even after sand has been poured into the oxygen inlet! Complete disassembly, reassembly in three minutes with no special tools! *Folder on request.*



Revolutionary New **K-G** Single Stage **REGULATORS**

Send for NEW 24-page CATALOG
Distributors: Write for franchise information.

The K-G Equipment Co. (Inc.)
Dept. B, 1744 Lehigh St., Allentown, Pa.

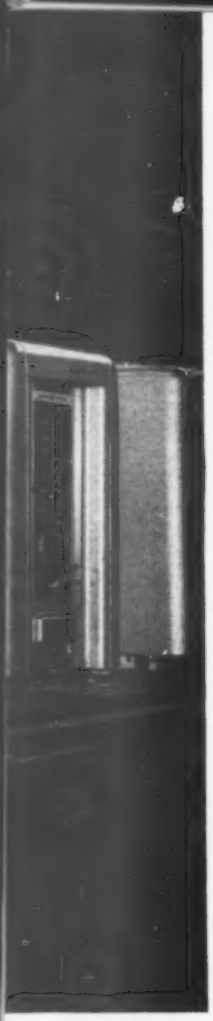
Circle No. 19 on Reader Service Card.

WELDING ARCS NEWS

LONG-LIFE WELDERS ASSURED BY MODERN TESTING AT NEW G-E PLANT

NEW G-E WELDING PLANT provides modern facilities for new standards in welding equipment.

PERFORMANCE TESTING backs up new design and materials for a-c welders.



G.E. announces a NEW line of long-life a-c transformer welders

new design and materials backed up by exacting quality controls, including 20 life-tests, 21 inspections

General Electric now brings you a new line of a-c transformer welders, available in 300-, 400-, and 500-amp models. This modern equipment features new design and materials for increased life-span—backed up by extensive quality control, and testing.

MOVING-COIL DESIGN reduces wear and vibration normal to other types of welder design. Together with G.E.'s logarithmic scale, moving-coil design assures pinpoint accuracy in current settings.

IMPROVED AUTOMATIC "HOT START" gives you instant arc striking—*throughout the current range.*

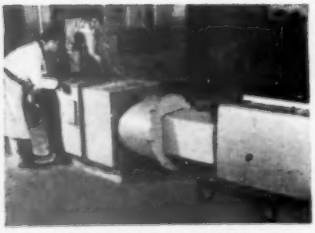
MORE PROTECTION against overheating damage caused by short-time overloads is provided by silicone insulation on all coils. Silicone, by test, withstands temperatures which disintegrate ordinary varnishes.

EVEN QUIETER OPERATION than normal for a-c welders is achieved by a special vibration-insulating mount for coil supports.

ADDITIONAL G-E FEATURES include idlematic control; arc-stabilizing capacitors; open construction and removable side covers for easy servicing.

Ask your G-E welding distributor today for bulletin GEA-6243. His name is listed in the yellow pages of your phone book. General Electric Co., Schenectady, N. Y.

710-20E



PROPER COOLING of welders, for dependable service, is checked in air-flow test.

SIX TIMES RATED VOLTAGE is applied to coil to test performance under overloading.

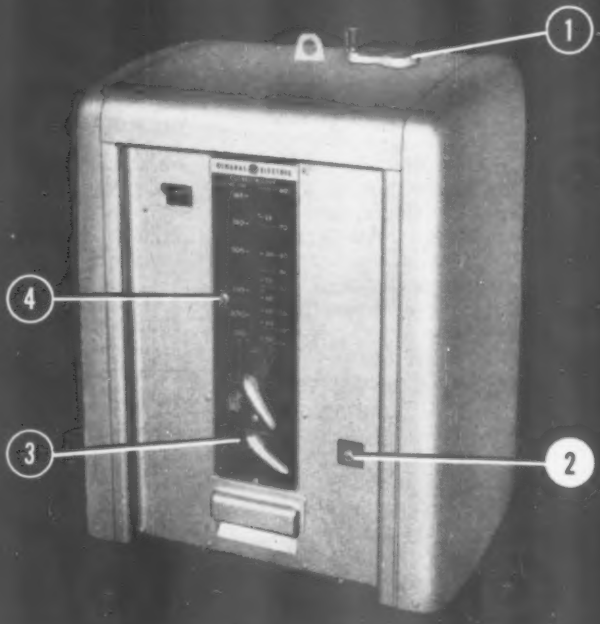
	General Electric	Company A	Company B	Company C
Moving Coil Design	✓			✓
Aluminum Windings	✓	✓		
Silicone Insulation	✓			
Hot Start	✓	✓	✓	
Arc Stabilizing Capacitors	✓	✓		
Large Logarithmic Current Scale	✓			✓

COMPARISON shows the new G-E a-c welder is your best buy. Turn page.

GENERAL ELECTRIC

Circle No. 21 on Reader Service Card.

NEW G-E 300-amp rectifier welder offers full-time arc-force control



. . . and many improved features, including:

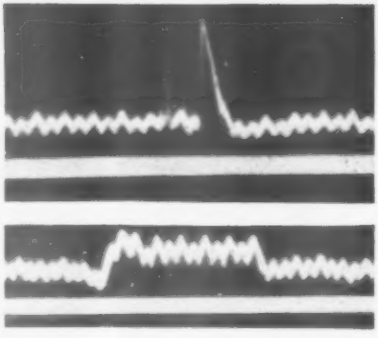
1 **FINGERTIP-ADJUSTABLE MOVING COIL:** provides stepless current control for pinpoint accuracy, reduced wear and vibration. Wide current range is 20-375 amps.

2 **ARC-FORCE CONTROL IS FULL TIME:** does not cut out in the middle of an electrode. High arc force blasts away short-circuiting metal drops, which often freeze short arcs. Results—unusual arc stability, deep penetration.

3 **REVERSING POLARITY SWITCH:** conveniently mounted for instant changing from straight to reverse polarity.

4 **SPRING-LOADED CLEANOUT SWITCH** reverses ventilating fan for blowing dust off rectifiers—prolongs equipment life.

Write your G-E welding distributor for bulletin GEA-6242. His name is listed in the yellow pages of your phone book.

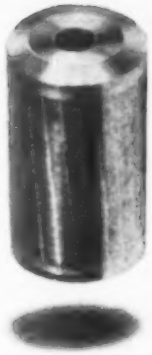


WITHOUT ARC-FORCE CONTROL, (lower graph), long short-circuit cools metal, freezes electrode. With G-E full-time arc-force control (above) short circuit is brief, metal is blasted away.

GENERAL ELECTRIC

BEFORE BRAZING OPERATION

ROTOR SHOWN IS ENLARGED APPROXIMATELY THREE TIMES ACTUAL SIZE



AFTER BRAZING AND MACHINING

This Rotor Is An Integral Part Of A Servo Motor, Product Of

SERVOmechaNISMS, INC.

Midget Rotor Induction Brazed With *Pre-placed* PHOSON *Rings!*

Elements and components of Servomechanisms must be assembled with incredible precision plus exceptional durability. For instance, operational requirements call for the rotor shown above to be rotated at 400 revolutions per second at temperatures ranging from −150° F to over +200° F. The joints in this bonding must have high conductivity, and no flux can be used in joining. They must also be free of any tendencies toward corrosion or crystallization and must have exceptionally high strength. This special bonding problem was one of the biggest production hurdles facing Servomechanisms, Inc. until the one right solution was found in PHOSON.

Yes, United's PHOSON was the one brazing alloy found that fulfilled all of the requirements.

Dependable, low cost PHOSON is a product of 8 years of research . . . field tested and performance proved. For Brazing Coppers — Bronzes — Brasses — Use PHOSON and get the best results for the least cost!

Send for new PHOSON folder B-532 today. Find how PHOSON will fit in your brazing picture!

USE SIL-BOND ALLOYS FOR FERROUS METALS

UNITED WIRE

AND SUPPLY CORP.

Brazing Alloy Division

PROVIDENCE 7, R. I. • OFFICES IN PRINCIPAL CITIES

Ask to see the new United Wire color film "When Metals are Brazed". Write for showing dates and literature.

Circle No. 20 on Reader Service Card.

← Circle No. 22 on Reader Service Card.

Literature Featured In Ads This Month

CIRCLE ON ENCLOSED POSTCARD, NUMBERS OF LITERATURE YOU WISH TO RECEIVE

1 **Two new welding helmets** with popular narrow-front style are featured in literature. JACKSON PRODUCTS. Inside Front Cover.

2 **Really automatic welding** with new welder and conversion kit is featured in bulletin. HOBART BROS. CO. Page 1.

3 **New metallizing gun** is subject of available literature. METALLIZING CO. OF AMERICA. Page 2.

5 **Arc welding connection devices** and electrodes holders are featured in 1955 Caddy Catalog. ERICO PRODUCTS, INC. Page 4.

6 **Flexible shaft tools** for weld grinding and finishing are described. R. G. HASKINS CO. Page 6.

7 **Powdered iron electrode** is described in new catalog. WESTINGHOUSE ELECTRIC CORP. Page 7.

10 **Automatic arc stabilizer** for inert arc welding is described in bulletin. MID-STATES WELDER MFG. CO. Page 10.

11 **Turning rolls** for manual and automatic welding are featured in specifications brochure. ARONSON MACHINE CO. Page 11.

12 **Single-phase spot welders** that are press-type and air-operated are featured in Bulletin 324-2. SCIAKY BROS., INC. Page 13.

14 **Hard facing alloys** and spray welding equipment are featured in Manual 77. WALL COLMONOY CORP. Page 15.

15 **Preformed shapes and rings** for brazing are featured in literature. ALLOY RING SERVICE, INC. Page 17.

17 **Clutch-drive grinders** for weld grinding and finishing are described in Folder SP-2. MILWAUKEE ELECTRIC TOOL CORP. Page 19.

18 **Welding hose reel** that stores 150 feet of hose is described. UNITED SPECIALTY CORP. Page 20.

19 **24-page catalog** describes complete line of oxy-acetylene welding and cutting equipment and accessories. K-G EQUIPMENT CO., INC. Page 21.

21 **A-C transformer welders** are introduced in Bulletin GEA-6243. GENERAL ELECTRIC CO. Pages 22-23.

22 **300-amp rectifier welder** is featured in Bulletin GEA-6242. GENERAL ELECTRIC CO. Page 24.

20 **Brazing alloy** for use on copper, bronze and brass is featured in Phoson Folder B-532. UNITED WIRE & SUPPLY CORP. Page 25.

26 **Tungsten carbide tube rods** for hardfacing are described in literature. HAYNES STELLITE CO. Page 29.

(Continued on Page 28)

How Amsco® distributor saved eastern coal mine 50 man-hours down time

Eliminated replacement of costly crusher parts

A welding foreman's records, at an eastern coal mine, revealed this startling fact: Coal crusher segments, formerly requiring 75 man-hours for replacement, were recently repaired in 25 man-hours with Amsco hardfacing rod... *without removing the segments.* This meant a two-thirds saving in man-hours and elimination of a considerable replacement cost.

Plus this additional important fact: The Amscoated crusher teeth now handle greater tonnage of coal than was previously handled by the original, non-hardsurfaced segments.

This three-way saving—time, replacement cost, increased service life—was suggested by the local Amsco distributor, a man trained in the selection and proper use of hardfacing materials. His knowledge and skill are available to you, too. Why not call him today.

Brake Shoe

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

Circle No. 23 on Reader Service Card.

(Continued from Page 26)

8 **Welding and cutting equipment** is featured in complete catalog. DOCKSON CORP. Page 33.

32 **Electrode selector chart** catalogs just about every type of welding electrode. McKAY COMPANY. Page 35.

33 **Arc and oxy-acetylene welding equipment** are featured in two new catalogs. LIQUID CARBONIC CORP. Page 36.

34 **Guide to low temperature brazing operations** is offered. AMERICAN PLATINUM WORKS. Page 37.

35 **Money saving chart** give quick solutions to toughest inert arc welding problems. SYLVANIA ELECTRIC PRODUCTS, INC. Page 38.

42 **Fume exhaust devices** are featured in Bulletin 37-E. RUEMELIN MFG. COMPANY. Page 46.

44 **Production brazing** at low cost is featured in Bulletin 20 on brazing alloys. HANDY & HARMAN. Page 48.

45 **Welding positioners** and their specific advantages are featured in Bulletin WP-26. CULLEN-FRIESTEDT CO. Page 49.

46 **Reinforced grinding wheels** for weld grinding and finishing are featured. NORTON COMPANY. Pages 50-51.

47 **New method of electrode storage** and packaging is featured. A. O. SMITH CORP. Page 52.

(Continued on Page 30)

THE NAME PREFERRED BY THOSE WHO KNOW WELDING!

Trindl

SUPER-INDUSTRIAL

ARC WELDERS

FOR EVERY JOB AND EVERY PURSE

OUTSTANDING FEATURES ASSURE PEAK WELDING EFFICIENCY!

DESIGNED FOR CONTINUOUS OPERATION ● MORE STABLE ARC ● SAFETY ASSURED ● NO MOVING PARTS TO WEAR
HEAVY DUTY TRANSFORMER ● EYE LEVEL CONTROL PANEL
DEPENDABLE PRODUCTION ● SIMPLIFIED OPERATION
SUPERIOR ENGINEERING ● DURABLE CONSTRUCTION
EXTREME PORTABILITY ● LOW OPERATING COST

Trindl D17 Carbon Arc Torch fits every AC-DC Arc Welder.

TRINDL PRODUCTS, LTD.
1807-11 S. Clark Street • Chicago 16, Illinois
Dept. T34-K

Circle No. 25 on Reader Service Card.

19 Times the LIFE... by ***Hard-Facing***

Mixer blades hard-faced with HAYSTELLITE tungsten carbide tube rod have been operating for 20 months—and are still in good condition. They have mixed 36,000 cubic yards of concrete, operating on a 3-shift, 6-day week. Unprotected blades had to be replaced after only 4 to 5 weeks service. Hard-facing has eliminated more than 19 shutdowns here, and replacement and maintenance costs have been cut sharply.

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(Continued from Page 28)

50 **Head, face and eye protection equipment** is described in literature. CHICAGO EYE SHIELD CO. Page 60.

52 **Aluminum application chart** describes welding of that metal. ARCOS CORP. Page 68.

54 **Cast iron welding electrode** is subject of booklet. INTERNATIONAL NICKEL CO. Pages 72-73.

55 **Everything for automatic welding** is featured in new Raco bulletin. REID-AVERY CO., INC. Pages 76-77.

57 **Toggle clamp catalog** gives information on clamping for better welding. ERICO PRODUCTS, INC. Page 81.

58 **Metallizing for production salvage** is subject of Bulletin 57-C. METALLIZING ENGINEERING CO. Page 83.

59 **New iron powder electrode** is introduced in available literature. A. O. SMITH CORP. Pages 84-85.

62 **Buyers' guide contains information** on line of arc welding electrodes, oxy-acetylene welding and brazing rods and alloys. ALL-STATE WELDING ALLOYS CO., INC. Page 93.

63 **New engine driven arc welder** is featured in Bulletin. HARNISCHFEGER CORP. Pages 94-95.

64 **Circle projector** which makes perfect circles on curved or cylindrical surfaces is featured in Bulletin 38R. HOPPER COMPANY. Page 99.

65 **40-page cutting torch brochure** tells everything about cutting torches and their use. NATIONAL WELDING EQUIPMENT CO. Page 100.

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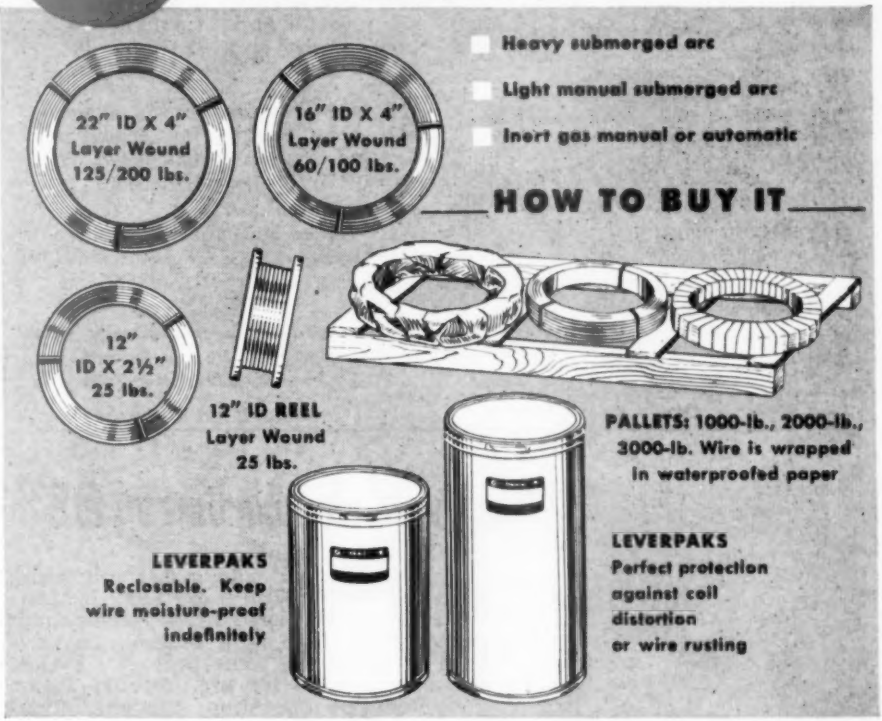
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Catalog 631-A. FRANKLIN BALMAR CORP. Page 106.

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75 **Cutting arc welding costs** is subject of Bulletin 459. LINCOLN ELECTRIC CO. Page 114.

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84 **Money-saving applications** of carbon arc-air gouging tool are described in free bulletin. ARCAIR CO. Page 139.

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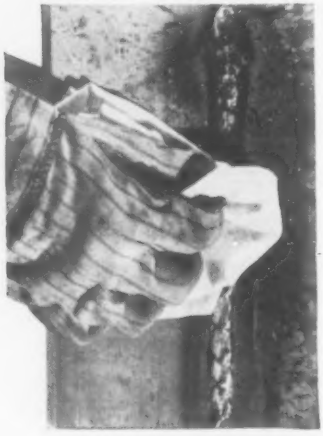
90 **Trailer couplers** are featured in Brochure 18-J. HAMMER BLOW TOOL CO. Page 146.

91 **Quick-disconnect electrode holders** are featured in Bulletin No. 121. CAM-LOK DIVISION. Page 147.

(Continued on Page 34)



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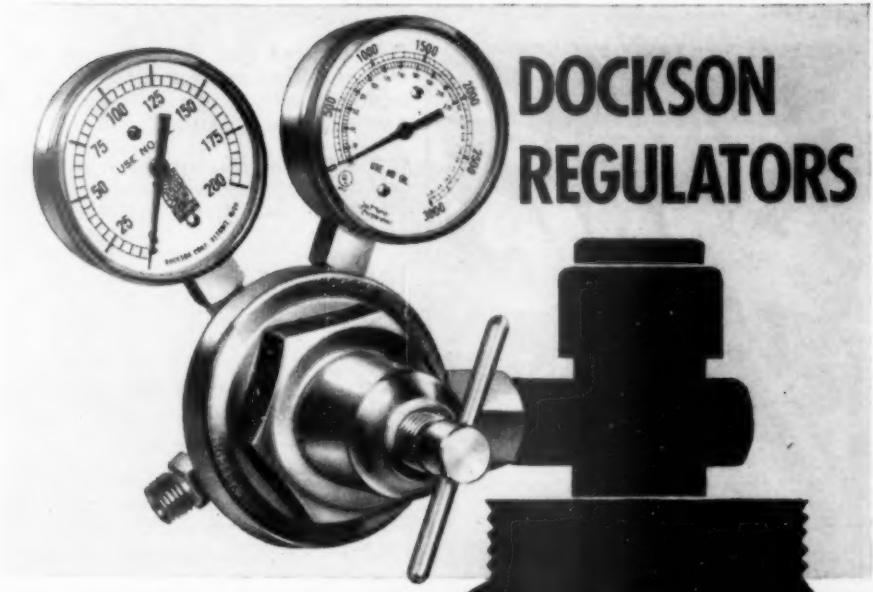

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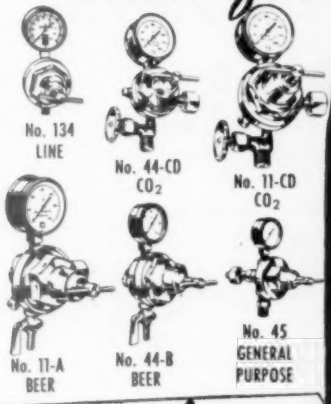

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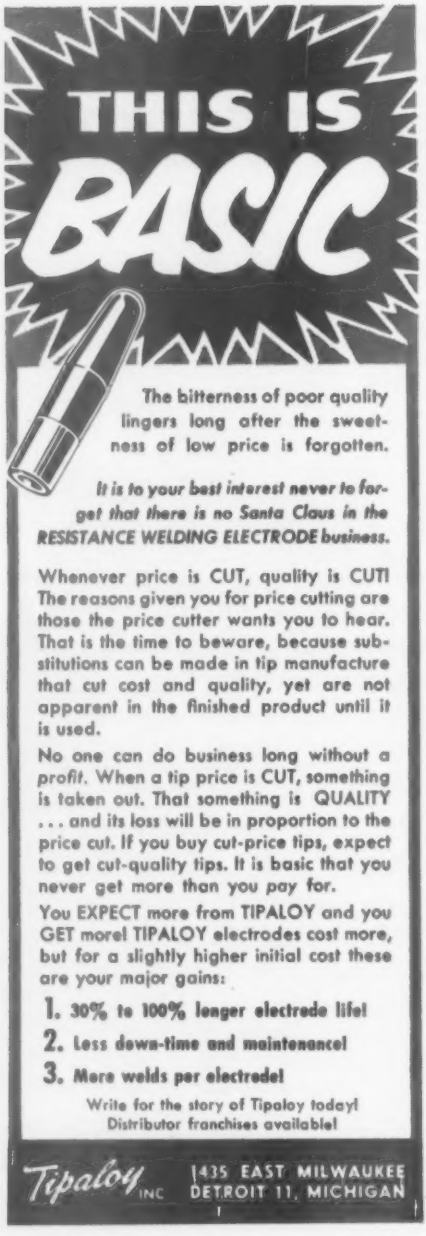
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96 **Welding flux recovery systems** are described in free folder. INVINCIBLE VACUUM CLEANER MFG. CO. Page 153.

100 **AC-DC ammeter** is featured in Tong Test Bulletin LW-100. COLUMBIA ELECTRIC MFG. CO. Page 155.

108 **Safety clothing and gloves** are featured in descriptive literature. ALJAY MFG. CO. Page 161.

109 **Complete clamp catalog** contin information on clamps that are shielded against spatter. ADJUSTABLE CLAMP CO. Page 161.

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120 **Welding and set-up platens** are featured in catalog. STAHL EQUIPMENT CO. Page 167.

122 **Tractor grouser retreads** are featured in catalog. ALLIED STEEL & TRACTOR PRODUCTS, INC. Page 168.

123 **Fluxes for welding, brazing and soldering** of every metal and alloy are featured in Fluxine Bulletin. KREMBS & CO. Page 168.

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The arrows point to the Silvaloy-brazed joints

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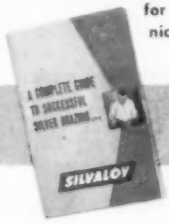

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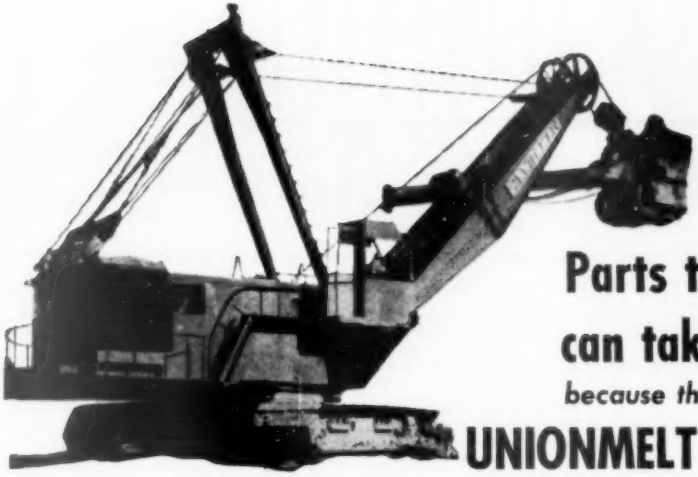

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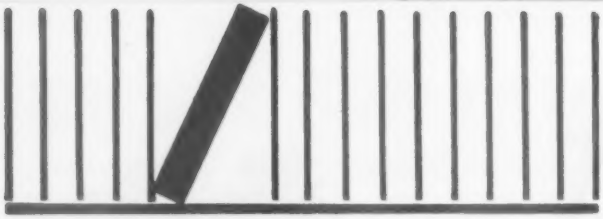

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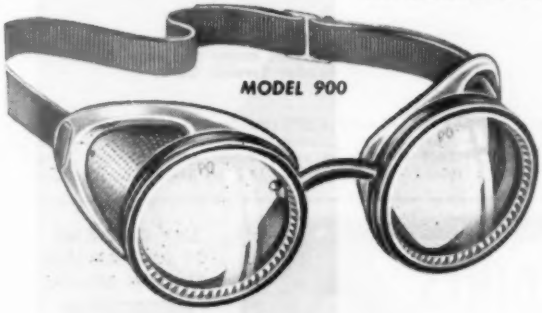

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INFORMATION ON INERT ARC WELDING TECHNIQUES and tungsten welding electrodes are provided in a new folder now being issued by Sylvania Electric Products Inc. Problems described, and their remedies, include difficult starting, brittle electrode tips, excessive heat in electrode or holder, metal pickup, erratic arcs, poor penetration, etc. **Circle No. 35.**

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REFERENCE BOOK ON GRINDING WHEELS bound in an attractive bright new plastic has been issued by Chicago Wheel & Mfg. Co. All types of grinding wheels, flex wheels and cut-off wheels are fully described in a most conveniently indexed form. **Circle No. 143.**

HOW TO OPERATE AND HOW TO CHOOSE the suitable cutting and gas-arc welding products for the job are explained in condensed 52 page catalog just made available by Air Reduction Sales Co. **Circle No. 144 on Reader Service Card.**

INFORMATION ON INERT ARC SPOT WELDING torch control panel is given in bulletin 9005 prepared by Mullenbach Electrical Mfg. Co. The bulletin featuring welding control gives complete operating details and construction data. **Circle No. 145 on Reader Service Card.**

"COOLIE" ARC WELDING ELECTRODE HOLDER is described in new bulletin available from Cam-Lok Division of Empire Products, Inc. Detailed information on the holders' special construction is revealed. **Circle No. 146 on Reader Service Card.**

HOW TO USE FLUX FOR ALUMINUM SOLDERING is revealed in comprehensive literature now available from Insulation and Wire Inc. This handy booklet includes detailed information on Aluma-Flux applications. **Circle No. 147 on Reader Service Card.**

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ENTIRELY NEW ARC WELDING PROCESS and its unique advantages are described in a brochure now being offered by Bernard Welding Equipment Co. The question, "what is it?," is answered in illustrated outline form. **Circle No. 148 on Reader Service Card.**

HANDY FOLDER ON TORCH GUIDED CUTTING has been published and is being offered by Heath Engineering. It shows the convenience of low cost circle cutting without patterns. **Circle No. 39 on Reader Service Card.**

COMPLETE INFORMATION ON PRODUCTION LINE HIGH FREQUENCY BRAZING and soldering is available from Electric Arc, Inc. Valuable new brochure contains data and applications of high frequency induction heating equipment for production. **Circle No. 149.**

DATA ON ENGINE DRIVEN WELDERS. The Lincoln Electric Co. has recently published literature on industrial shield-arc welders. This booklet covers the uses and application of these welders in illustrated style. **Circle No. 150 on Reader Service Card.**

FUNDAMENTAL WELDMETALLURGY of the new "weldbrazing" process for steel is given in a booklet offered by Uniworld Research Corp. of America. Important advantages of this new method of joining at low temperatures are described. **Circle No 151 on Reader Service Card.**

RESISTANCE WELDING REFERENCE INFORMATION is contained in a recently revised catalog by Welding Sales & Engineering Co. Tuffaloy resistance welding alloys, electrodes, holders, wheels and forgings are included. **Circle No. 152 on Reader Service Card.**

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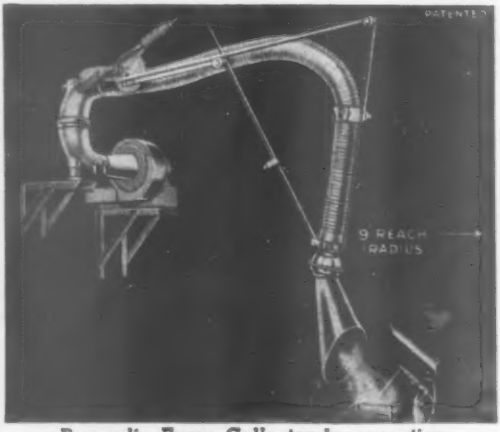

Ruemelin Fume Collector in operation.

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed. Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle. Ask for Bulletin 37-E illustrating this new feature.

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Combining the best in welding arc characteristics with the highest physical properties known to steel producers today . . . *ATOM* ● *ARC* electrodes meet the stern requirements of the Atomic Age.

Compare Atom • Arc with Ordinary Low Hydrogen Electrodes

Faster . . . For the first time in the industry, *ATOM* ● *ARC* utilizes iron powder in the electrode coating of a low hydrogen electrode—making possible the use of higher welding currents with either A.C. or D.C.

Greater Deposition Efficiency . . . Amazing deposition efficiencies are made possible because iron powder contained in the electrode coating serves as an additional source of weld metal.

No Moisture Pick Up . . . *ATOM* ● *ARC* is packed in 50-lb. hermetically sealed metal containers. Electrodes will effectively resist detrimental moisture pick up for ten days after opening container.

Weld Appearance . . . The full covering, easy to remove slag helps to form a smooth, uniform weld bead—free of undercut.

Ease of Welding . . . *ATOM* ● *ARC* reduces welder fatigue because the heavy electrode coating permits contact with the work in all positions.

Highest Physical Properties . . . *ATOM* ● *ARC* is manufactured in six A.W.S. low hydrogen grades and will meet all specifications for these types of electrodes.

▶ *Call your Alloy Rods Company distributor or write direct to nearest plant for further information or demonstration.*

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It's a safe bet you can get a better product at much lower cost on several of your metal parts by designing them for EASY-FLO or SIL-FOS silver brazed construction—supplemented by a simple production set-up that makes the brazing so easy—anybody can do it!

Here's an example—a radiator valve. It is made of a simple drawn body and a screw machine part, brazed with EASY-FLO. And the joining is done on a set-up that "automation-izes" the actual brazing. The net results—a smaller, trimmer valve—a favorably low production cost.

EASY DOES IT—An endless chain runs at predetermined speed between a pair of city gas-air burners. Operator merely places bodies in angle-iron carriers, dips spuds with preplaced EASY-FLO rings, in Handy Flux and sets them in bodies. The rest is automatic. Using only one row of carriers, output is 18 a minute.

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In cooperation with the manufacturer we worked out the valve brazing set-up—and we're ready to work with you. As originators of EASY-FLO and SIL-FOS low-temperature silver brazing alloys, we offer you the benefit of the maximum technical knowledge about the process and practical experience in its application available anywhere today. There's no obligation for this assistance. Just phone or write and say when you would like a field service engineer to call.

FOR THE FACTS IN PRINT...

Write for Bulletin 20. It gives them all plus a lot of useful information about fast, low-cost production brazing.

At the METAL SHOW—Chicago—Nov. 1-5
SEE the comprehensive exhibit of low-temperature silver brazing jobs from many industries. Our engineers with the know-how will be there ready and waiting to chat with you about your metal joining. ***BOOTH 342***

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Weldors spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

Write for Bulletin WP26—an illustrated circular detailing the *Specific* advantages of C-F Positioners.

Cullen-Friestedt Co., 1315 S. Kilbourn Ave., Chicago 23, Ill.

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

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Norton reinforced wheels bring you many "extras"

Outstanding for strength, service life and cutting action, the BFR, BD and BF handle a wide range of weld grinding jobs with the profit-boosting

"TOUCH of GOLD"

Meet three popular Norton Reinforced Wheels that will save you time and money every time you put them to work.

They're the BFR, semi-flexible hub-type; the BD rigid hub-type; and the BF, semi-flexible straight. All are resinoid bonded and fabric-reinforced. Long-lasting, trouble-free, economical performance is their specialty — assured by combining extra-strong, laminated construction with the fast, cool cutting action of famous Norton abrasives.

BFR and BD hub-type wheels are designed for your right angle grinders; BF straight wheels are for periphery grinding only. Each handles many important weld grinding jobs — together they bring the cost-cutting, value-adding "Touch of Gold" to the widest range of operations.

See Your Norton Distributor about a demonstration of Norton Reinforced Wheels in your shop. Ask him for the new Reinforced Wheel catalog. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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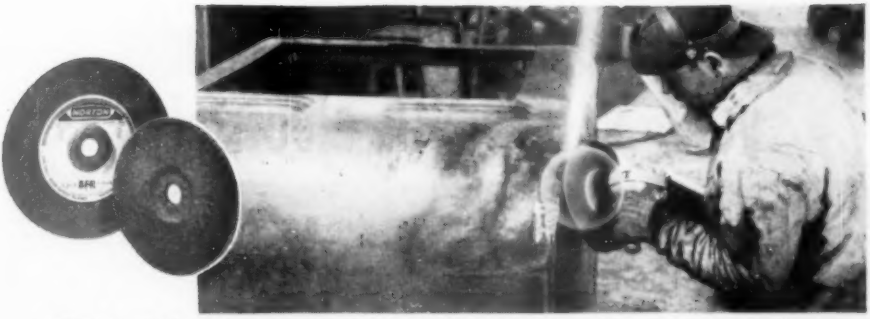
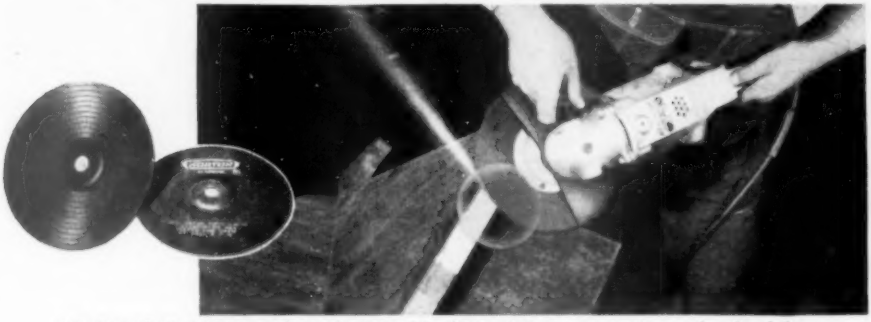
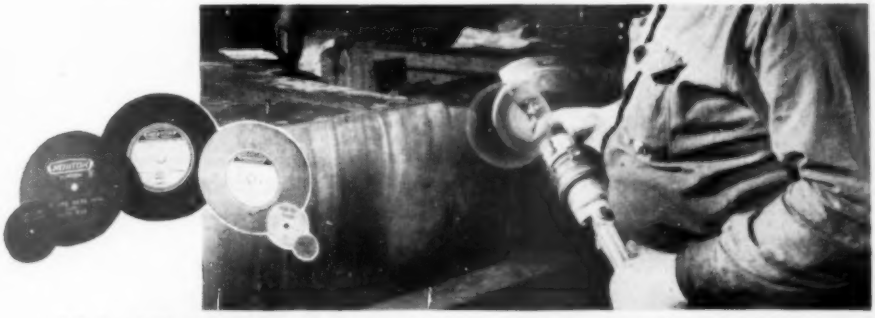


BFR *Semi-Flexible Hub-Type.* Cotton fabric and Nylon reinforcement. Popular for all light weld grinding applications, such as removing rust and scale, beveling, smoothing, blending contours and corners. Reaches hard-to-get-at places. Like the BD, it notches, slots and cuts-off.



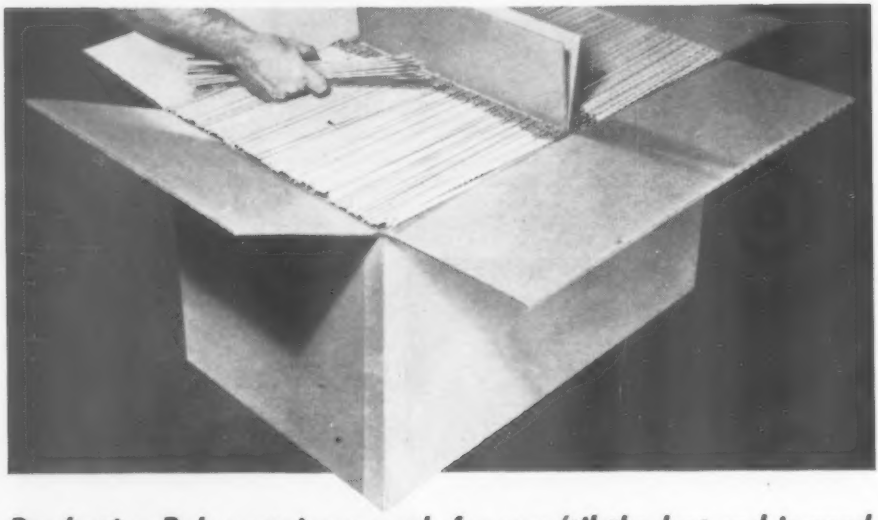
BD *Rigid Hub-Type.* Glass cloth and Nylon reinforcement. A tough wheel for your tough jobs. Excellent for cutting-away, smoothing and blending welds on fabricated work; making V-cuts to remove old weld material when salvaging steel parts; smoothing flame-cut edges and stainless steel welds.



BF *Semi-Flexible Straight.* Cotton fabric construction. This lightest Norton Reinforced Wheel is designed for light weld removal, smoothing, blending, etc. BF mounted wheels and points and hand sticks have the same laminated construction and are ideal for getting at hard-to-reach areas.

Circle No. 46 on Reader Service Card.

New modern way to handle your A. O. Smith electrodes



Production-Pak containers work for you 'til the last rod is used

If you use electrodes in *quantity*, this is for you!

A single Production-Pak contains approximately 2,000 lbs. of electrodes . . . as many electrodes as you'd get in 40 ordinary boxes. Think of the time and labor saved in unloading alone.

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Through research . . . a better way

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CORPORATION

WELDING PRODUCTS DIVISION, Milwaukee 1, Wisconsin • INTERNATIONAL DIVISION: MILWAUKEE 1

Circle No. 47 on Reader Service Card.

TITANIUM - - - Fusion Brazing with High Temperature Alloys

by Roger A. Long and Robert R. Ruppender
Aircraft Components Div., Ferrotherm, Inc.

Furnace brazing of titanium made it necessary to develop a new series of alloys which had a flow temperature within metallurgical limitations of the titanium base metal. It was evident that a "fusion" rather than a "diffusion" brazing alloy was required. This "fusion" alloying could minimize formation of intermetallic layers and resulting planes of weakness at interfaces and help form a strong bond.

BRAZING filler alloy developed had to meet the following requirements:

1. It must melt and flow freely at a temperature which will not adversely affect metals being joined.

2. It must alloy with the parent metal with little or no formation of brittle phases, particularly in layers.

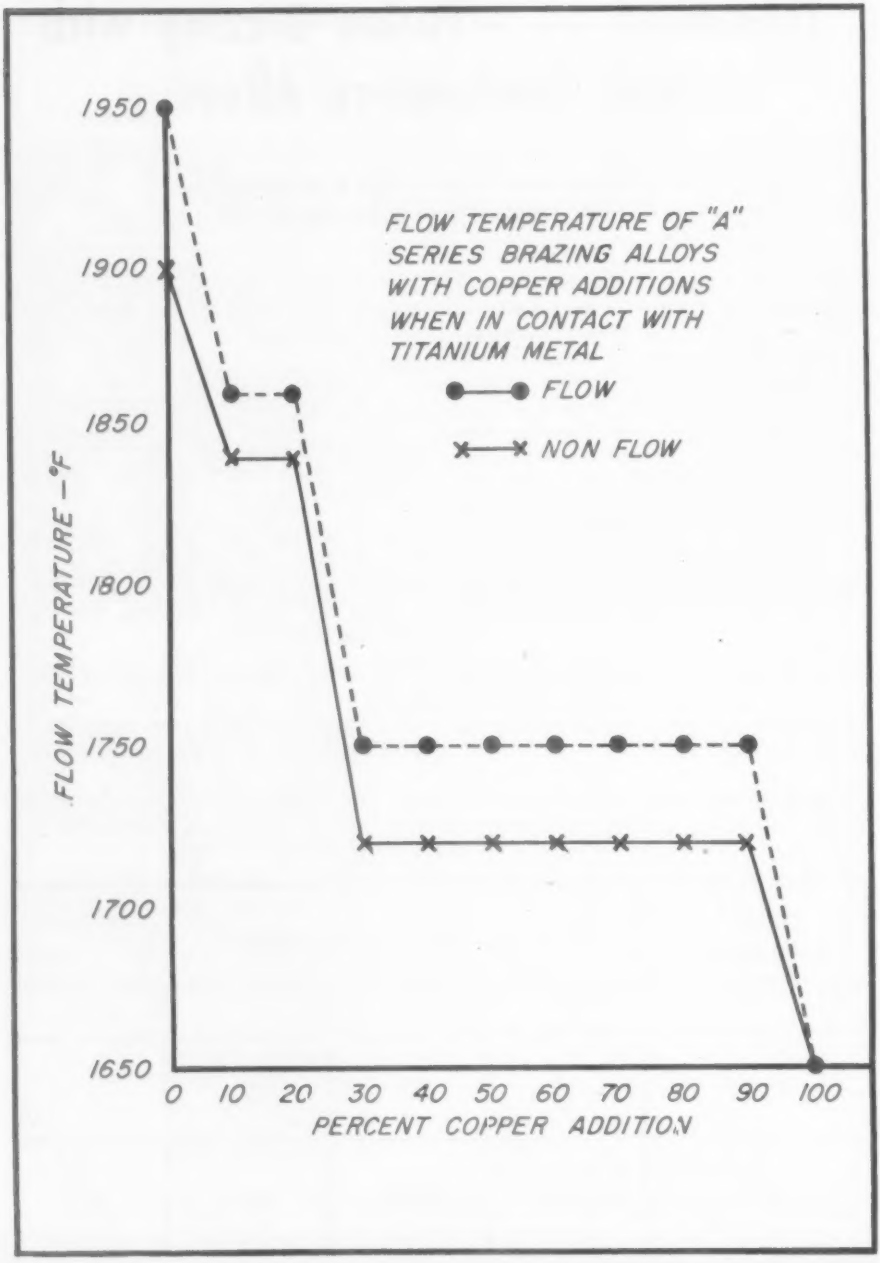
3. Alloy phases formed in interface must have strength and ductility equivalent to the minimum required for any particular application.

4. Washing or erosion between the brazing filler metal and the parent metal must be controllable within the limits required for the brazing operation.

5. Temperatures required for braze filler metal flow and to which parent parts are subjected must not be so high as to result

Typical brazing alloy compositions are shown here. Most promising results have been obtained with nickel-base Series A alloys. Titanium-base Series B4 alloy is being used only on an exploratory basis for this series.

Alloy Designation	*Percent Composition*			
	TI	*NI*	*CU*	*CO*
A 7a	*28*	*52*	*15*	*5*
B 4	*64.35*	*25.65*	*10*	*0*


FLOW TEMPERATURE OF "A" SERIES BRAZING ALLOYS WITH COPPER ADDITIONS WHEN IN CONTACT WITH TITANIUM METAL
FLOW
NON FLOW
FLOW TEMPERATURE — °F
1950
1900
1850
1800
1750
1700
1650
0
10
20
30
40
50
60
70
80
90
100
PERCENT COPPER ADDITION

in detrimental structural changes with resulting low mechanical properties.

6. Alloying elements of the braze filler metal must have low volatilization characteristics at brazing temperatures.

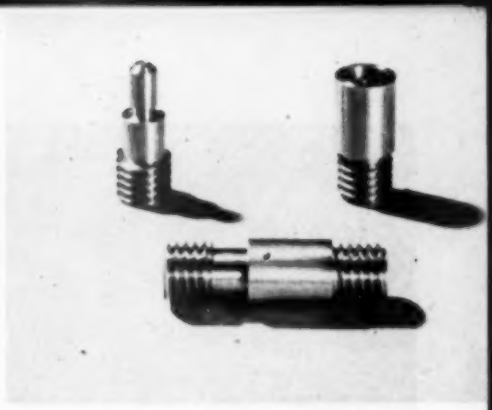
7. It is desirable that brazing alloy combine with parent metal to form an alloy with a higher melting temperature.

Select Alloy System

In addition to these basic requirements, it was desirable to select an alloy system which would be compatible with titanium and be self-fluxing to some degree. Self-fluxing means an alloy which will dissolve the oxides and nitrides of titanium to some small extent, but sufficient to allow a commercial atmosphere to be used.

A preliminary analysis indicated that the nickel-titanium system looked the most encouraging. In this system there are two usable eutectics, one at about 66 percent nickel and the other at about 28 percent nickel. The higher melts at about 2030°F, while the lower melts at about 1750°F. If one adds titanium to either, there is a rapid increase in solidus temperature, indicating that brazing may be possible without appreciable "washing" effect.

It can be seen as we braze and alloy, titanium is dissolved and new phases are formed. The number of new phases formed within the joint area are those phases present to the left of each eutectic. The low nickel eutectic results in a minimum number of resultant phases and from this aspect looks very interesting. It is desirable, in most cases, to have solid solution phases formed whenever possible. The higher nickel eutectic has a greater probability of forming undesirable brittle phases, but has



Tensile shear data on these specimens averaged approximately 43,000 psi. All failures occurred in parent metal outside brazed joint. Highest value was 48,000 psi and lowest 37,000 psi.

advantages in that the properties are not affected by small gaseous elements, such as would be the case with high titanium-low nickel eutectic.

Experiment on Titanium-Nickel

Experimental work was done on both titanium-nickel eutectics. Initial flow temperature data indicated that temperatures in excess of 1950°F were necessary for flow and were primarily responsible for embrittlement of the base parent metal because oxygen from furnace leakage and nitrogen impurity in argon are more active at high temperatures.

When in contact with titanium, these gases are absorbed in increasing speeds as temperature increases. The reason for the high melting temperature of the high titanium eutectic is not known, but material used was at least 200°F higher than the 1750°F shown earlier.

Samples of commercially pure titanium were run in argon atmosphere furnace for various times and temperatures. From these tests, a maximum permissable temperature of 1950°F was indicated

Joint area brazed with A7a alloy is typical of structures obtained with fusion brazing alloy. Fusion area is approximately 0.015-inches wide. Original gap clearance was 0.002-inches. There has been no evidence of failure in this zone in any tensile shear specimens.

and time periods up to 30 minutes were found to be satisfactory. This established the very top limit of brazing conditions as to commercially pure titanium and dictated the selection of the brazing alloy.

Wettability of brazing alloy is dependent upon the base metal, brazing alloy composition and temperature. The latter is one of the most effective means of increasing wettability. However, because of limiting of maximum flow temperature, full advantage could not be taken. Brazing filler alloy composition seemed to be the next best approach.

Addition of Copper Lowers Flow Temperatures

Additions of copper were found to be most expedient in lowering the flow temperature of both titanium-nickel base eutectics. However, it was felt that these high percentages of copper would be detrimental to the mechanical properties of the brazed joint because of its known embrittlement characteristics with titanium.

Other tests indicated that copper contents ranging up to 15 percent would be permissable and would effect a substantial lowering of the flow temperature. Small percentages of cobalt, chromium and manganese, separately or in combination were not found to have a detrimental effect on flow temperature of either base eutectic containing up to 15 percent copper. In fact, additions up to 4 percent supplemented the copper and allowed use of slightly less copper in order to obtain equivalent flow temperatures.

Element balancing must also be considered from its possible effects on the braze joint properties. This is particularly important when we are dealing with a "fusion" brazing alloy where there is a fairly wide fusion zone across which the hardness can vary considerably. It was felt that if the hardness of the joint from parent metal to parent metal could be kept uniform or within reasonable uniformity, a better

(Continued on Page 92)

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A: One big factor is the quality of the electrode used.

Q: How can you be sure of getting the best electrode?

A: By insisting on Alcoa's new I.G.* Electrode.

Q: Why?

A: Every production lot of Alcoa® I.G. Electrode is test welded and the welds X-rayed for soundness. Each 10-lb spool is individually packed to maintain the super-smooth finish to assure soundness of weld and smoothness of feed. Each of three alloys, 1100, 4043 and 5154 (formerly 2S, 43S and A54S), is available in six diameters. There is no better electrode. *inert gas

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A new, 176-page text, *Welding Alcoa Aluminum*, has just been released by Alcoa. It covers every phase of welding in complete detail. For a free copy, fill in and mail the coupon.

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A: Contact your nearest Alcoa sales office, or, for immediate delivery, call one of the Alcoa Distributors listed below. He carries a complete range of alloys and sizes and you'll find him well qualified to work with your welding experts.

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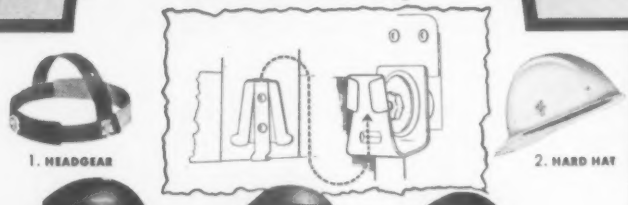

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Items **A, B** and **C** can be used with either items **1** or **2** illustrated above so you can make six different combinations. The old-fashioned way you would buy a helmet and headgear, a shield and headgear, and so on until you had six combinations (twelve items) to do the same thing these five separate pieces will do.

The New CESCO Mounting has an easily adjusted tension spring to compensate for weight differences. Tilting mechanism permits easy raising and lowering. Wedge shaped brackets slide apart or together quickly, and lock securely.

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Circle No. 50 on Reader Service Card.

Welded ships had a remarkable performance record in the Second World War. They remained floating many times after hits or near misses, where riveted boats would have sunk. The gaping hole in this 18,000 ton tanker failed to send her to the bottom. In spite of the explosion, the welded plates of the ship's compartments remained watertight. If the plates had been riveted, they would have been loosened and water would have flooded the ship's compartments. Not only hits, but near misses can have the same effect on riveted ships.

ARE WELDING CODES TOO STRICT?

You can stir up a lot of controversy when you start discussing welding codes and what's wrong with them, if anything.

Many manufacturers and users of welding machines and electrodes feel that greater advances in use of welding have been stymied by welding codes which are too strict, contradictory and unfair.

These constructive critics claim that many codes have not been engineered on the basis of service requirements; rather, they have been set up on a basis of what can be done and not what is required.

The guardians of the welding codes, as typified by the inspection agencies maintained by many insurance companies, feel that welding is getting a fair shake. They claim that various codes and regulations maintain necessary quality controls in construction and manufacturing operations. They add that codes are constantly being revised in light of additional data and that unduly severe requirements are being gradually eliminated.

(Editor's Note: The following two letters written by outstanding authorities in the field, argue each side of the case and are presented to give our readers a chance to decide for themselves. Comments—pro or con—will be welcome.)

What Do You Think?

THE LINCOLN ELECTRIC COMPANY

SHIELD ARC WELDERS · FLEETWELD ELECTRODES · WELDING SUPPLIES · SPECIAL ELECTRICAL MACHINERY

22801 ST. CLAIR AVENUE
CLEVELAND 17, OHIO February 24, 1954

Mr. Lew Gilbert, Editor
Industry and Welding
1240 Ontario Street
Cleveland, Ohio

Dear Mr. Gilbert:

Man's material progress depends on how well and how economically in time and money he can join things together. This has been true since the dawn of history and especially true since the steel age began.

For over forty years, arc welding has been a big factor in building the modern equipment used by man in every walk of life. However, progress is now being held back by limitations placed around the welding process by various codes, rules and regulations which are unduly severe.

These restrictions are promoted, no doubt, by well-intending persons who do not see the economic folly of what they are doing. Arc welding has produced a record for reliability in billions of welds, over the years, that is unmatched by any other manufacturing process. Yet arc welding is being tremendously handicapped in its application. This handicap is throwing suspicion on the process by writing into specifications expensive and impractical tests which have little to do with the excellence of the weld. Most of them have to do with infinitesimal variations of no possible importance but of high cost.

These restrictions have already eliminated the economic uses of welding in many proper applications, and if continued, it will eliminate many others.

With modern arc welding equipment and electrodes and with proper technique it is almost impossible to make a weld which will be weaker than a riveted joint.

We see welding electrode specifications being written, however, which enormously increase the cost of production with no increase in either the reliability or the excellence of the structure.

Much time and expense is used in testing electrode deposits to make sure they have great ductility. The weld is rejected if its ductility is low. Yet riveted joints have no ductility, relatively speaking, and are accepted without question.

(Continued on Page 102)

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MACHINERY DIVISION
C. W. R. JOHNSON, CHIEF INSPECTION ENGINEER

May 5, 1954

Mr. Lew Gilbert, Executive Editor
Industry & Welding
1240 Ontario Street
Cleveland 13, Ohio

Dear Mr. Gilbert:

Mr. J. G. Sylvester, Supervising Research Engineer of our Laboratory Division, has referred to us your April 5 letter for reply. Before answering some of the statements made by Mr. Lincoln of the Lincoln Electric Company we sounded out various experienced supervisors in our Boiler and Pressure Vessel Division. This reply, therefore may be considered a composite viewpoint of the best men in our Engineering Department.

Mr. Lincoln's point that welding has a definite place in our world is well taken and we agree with him. However, we cannot agree that carte blanche approval should be given for the use of welding for any and all classes of work. In any manufacturing or construction operation there must be quality controls. The various codes and regulations were designed to provide these needed controls for the protection of the users and the public. It is possible that some of these requirements may be unduly severe as Mr. Lincoln points out. But, they are constantly being revised in the light of additional data and the unduly severe requirements are being gradually eliminated.

In our opinion, Mr. Lincoln has missed the point entirely. In comparing the ductility of a riveted and a welded joint we agree that the riveted joint has little or no ductility but a welded joint, since it tends to make a seamless structure of the parts joined, must of necessity have a ductility comparable to that of the parent metal otherwise it would soon fail from the flexure of the points joined. Riveted joints, however, having a larger area and more holding components, can have failure of some of the components without the entire joint failing.

We believe too that Mr. Lincoln's statement regarding undercutting in riveted joints is not entirely true. In a properly caulked joint the edges of the straps are forced down against the parent metal and there is little or no undercutting of the parent metal, whereas in a welded joint the undercutting takes place in the parent metal which, if severe enough,

(Continued on Page 102)

HIGH conductivity forgings and castings for all resistance welding needs..

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Experience and technical skill identify WW ALLOYS. Long a leading reliable source of high conductivity, high strength forgings and castings—in rough or finished form—WW ALLOYS can meet any resistance welding requirement. And with the added advantage of WW's participation in Fansteel's continuous metallurgical research, you know you can count on WW for the job being right every time.

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Circle No. 51 on Reader Service Card.

Experience has shown there are a few combinations of ferrous and non-ferrous metals that cannot be welded with some degree of success by one of the resistance welding processes. Here's how - - -

Resistance Welding Joins Dissimilar Metals

IN resistance welding, the amount of heat generated depends primarily upon the current flowing through the pieces to be welded, and the resistance. The latter usually consists of (a) the resistance between the two pieces to be welded (b) the specific resistance of the pieces and (c) the resistance between the electrodes and the work.

If similar metals are spot welded, then the highest resistance is between the interfaces of the two sheets, provided that the right welding conditions are used.

In the case of welding two dissimilar metals, such as stainless steel to brass, the maximum resistance may not exist between the interfaces of the two sheets, but may actually be located within the stainless steel sheet, due to its very much higher specific resistance, as compared to that of the brass sheet. The actual heat which is created in the stainless steel and in the brass will be proportionate to the specific resistance of the two materials. Furthermore, it must be taken into consideration that, due to the low specific thermal resistance of brass, the heat losses in brass will be higher on account of heat being conducted away to the cooler parts much more rapidly.

An extreme case of difficult welding conditions is thus presented: nevertheless it has been possible to accomplish spot welds of acceptable strength for some purposes in this combination. More

Spot Welding Condition for Combinations of Dissimilar Metals

(Thickness each piece, 1/16-in.)

Combination, Two Pieces Each 1/16 In. Thick	Electrode Force, Lbs.	Weld Time, Cycles	Weld Current, Amperes	Weld Diam., Inch	Shear Strength, Lbs.
Nickel—Mild Steel	1500	10	16,200	0.25	2200
Nickel—8630 Steel	1500	10	14,500	0.25	2350
Nickel—18/8 Stainless	1800	12	16,000	0.25	2700
Nickel—Monel	2000	12	20,000	0.28	2900
Nickel—Inconel	2500	12	15,500	0.26	2750
Monel—Mild Steel	1600	14	17,500	0.25	2300
Monel—8630 Steel	1600	14	16,800	0.25	2450
Monel—18/8 Stainless	1800	14	16,000	0.25	2800
Monel—Inconel	2300	14	15,500	0.25	3000
Inconel—Mild Steel	1600	14	17,000	0.23	2200
Inconel—8630 Steel	1600	14	16,000	0.25	2300
Inconel—18/8 Stainless	2500	16	14,000	0.28	2950
18/8 Mild Steel	1600	14	18,000	0.25	2170
18/8—8630 Steel	1600	14	17,500	0.26	2400

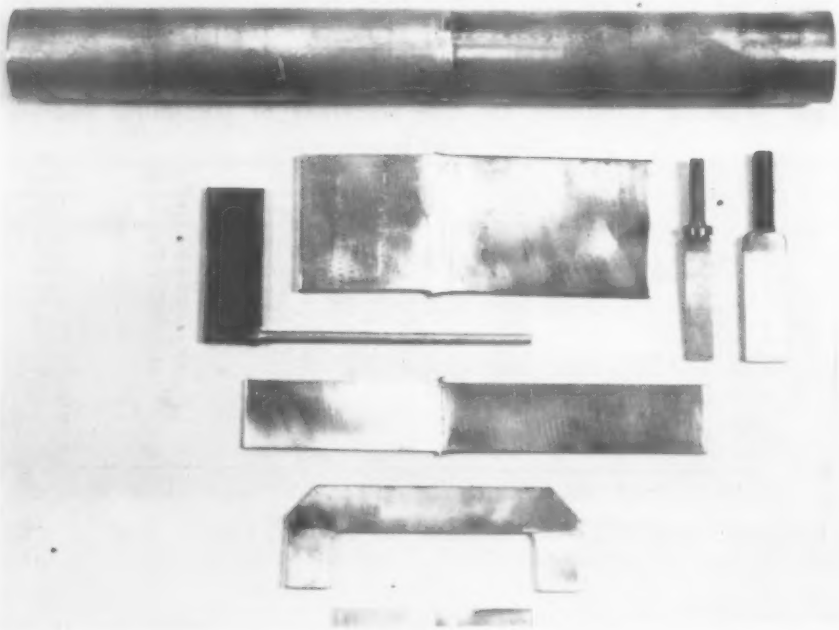
favorable welding conditions in this combination could probably be obtained by using one of the stabilized types of stainless steel and a yellow brass containing a small amount of silicon. Such design compromises are frequently worth while on account of improvements in production rates and weld quality.

Application of the resistance welding processes to the joining of dissimilar metals has had an important role in the manufacture of many types of apparatus. The electrical industry has furnished the widest range of combinations to be welded, and of special procedures and machines for the successful welding of these combinations. Experience has shown that all types of resistance welding may be used and that there are few combinations of dissimilar metals which are not weldable to some degree. Many combinations can be welded as readily as low carbon steel under favorable conditions as to shape and size of parts.

If the metals in any dissimilar combination are considered in their relative physical proportions and properties, a reasonably accurate forecast of their weldability may be made. Most of the combinations of iron base, or ferrous alloys can be welded. In the nonferrous alloys, the best welds will be made between two alloys which will form intermediate alloys, such as between Monel and some of the bronzes.

Development of satisfactory procedures for resistance welding of dissimilar metal combinations obviously involves the determination

Aluminum and copper sections were joined by these flash butt welds. Note wide variety of joint types.



...re the key to success" . . .

of proper settings for current, pressure and time. In addition, the following conditions need to be considered.

1. Relative electrical and thermal conductivity of the two metals.
2. Melting points of the two metals.
3. Plastic range.
4. Relative thickness.

These variables can be partly compensated for by adjustment of heat balance through electrodes or other means.

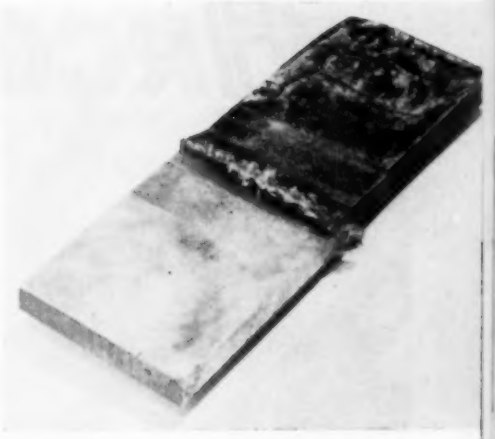
No hard and fast rules can be laid down for setting up welding procedures under such conditions, but the factors affecting each job must be studied as a whole.

A practical approach to any individual problem is to consider the weld as fundamentally a metallurgical process. Then the first step toward the solution is to secure a balanced heating effect. This should preferably be done before the design of each of the component parts is definitely fixed.

Furthermore there may be other important factors than heat balance to consider. Therefore it is not usually economical to go into production on component parts until it has been proved definitely that the design of each part is sound from a welding standpoint.

Another necessary preliminary is to assure the reproductibility of satisfactory procedures, by providing the welder with the greatest possible degree of precise and automatic control.

The recommended method of obtaining heat balance when spot welding combinations which differ widely in heat and electrical conductivity is the use of two dissimilar electrodes, such as one of copper alloy and one of a copper-tungsten alloy of high tungsten content.



Hard rolled copper was joined to 75S-T aluminum by this flash butt weld. Weld section is ½ by 3¼-inches.

For example, combinations like copper with galvanized iron or copper with nichrome (metals of widely different electrical and heat conductivity) may be welded by using a copper-alloy electrode next to the nichrome and an electrode of an alloy rich in tungsten content next to the copper. This will give a balanced heating effect, the low-resistance copper electrode in contact with the high-resistance nichrome helping to conduct away the excessive heat caused by the high resistance of the nichrome, while the heat in the low resistance copper alloy of the part being welded is intensified and localized by its contact with the relatively high-resistance copper-tungsten electrode. This causes the two dissimilar metals to heat evenly to the welding temperature.

A wide choice of electrode material is available, ranging from

(Continued on Page 113)

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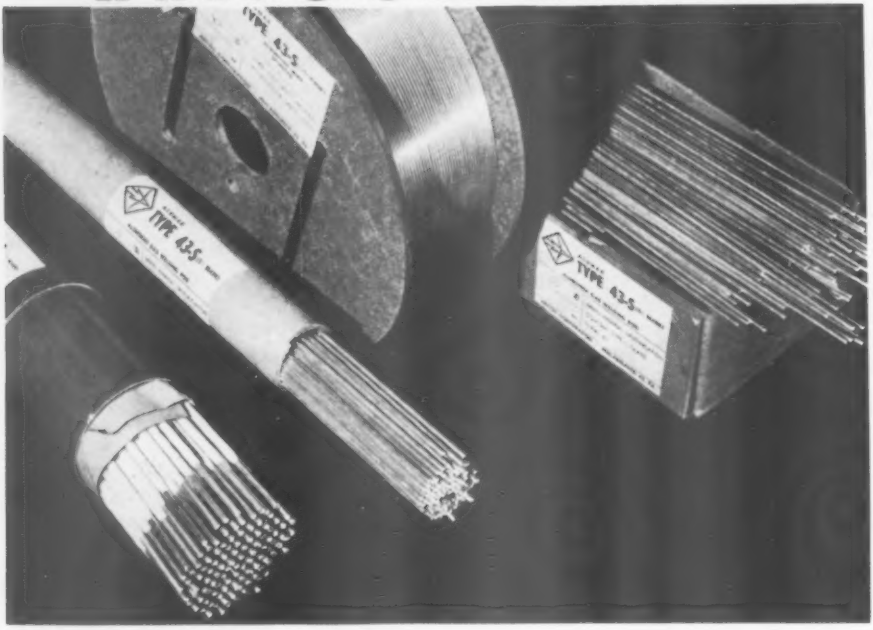

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WELD WITH ARCOS

ALUMINUM RODS AND ELECTRODES

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Manganese steel earth moving parts such as chain links of this large excavator bucket present special problems when welded repairs are necessary. Here's . . .

How to Weld MANGANESE STEELS

MANGANESE steel is widely used where its work-hardening properties are most useful. Typical applications are excavator teeth, lips of dredger buckets, crusher jaws and rail crossings. In almost every instance wear due to impact and abrasion is very severe and constant repairs and maintenance by welding have to be carried out.

Manganese steels can be welded satisfactorily by metallic arc welding, if correct electrodes and welding techniques are employed. However, in practice some difficulties are encountered because operators are not fully aware of some of the metallurgical factors.

Two Classes of Manganese Steel

Manganese steels fall into two general classes: plain manganese steels and nickel-manganese steels.

A typical analysis of a plain manganese steel is: carbon, 1.0-1.4 percent (optimum value 1.15 percent); silicon, 1.0 percent maximum and manganese, 10-14 percent (optimum value 12 percent).

These steels are quite brittle in the as-cast condition, their characteristic toughness being produced by heat treatment. In this they are soaked in a furnace for 20 to 30 minutes at 1000°C and are quenched in agitated cold water.

This treatment produces an austenitic structure in the steel.

A point to note is that decarburization and loss of manganese during heat treatment makes the skin of the steel martensitic instead of austenitic and causes it to become weakly magnetic. In this condition the skin is more brittle than the underlying metal and deformation in service will sometimes produce numerous small surface cracks.

Although these cracks usually terminate at the internal austenitic structure and service life of the steel is not appreciably affected, it is worth remembering that very severe fatigue conditions can lead to propagation of these cracks and eventual failure.

Work-Hardens In Service

After toughening process, manganese steel in service under conditions of impact is work-hardened. The speed at which the work-hardening takes place depends upon the weight of the blows; the heavier these are, the more rapid the increase up to maximum hardness.

It should also be clearly understood that reheating this type of steel can destroy its toughness and produce embrittlement. As welding must inevitably heat the base metal, it is most important to keep the heat input down to a minimum. The temperature of a casting or weldment should never be allowed to exceed 250°C during welding and if reheating embrittlement is to be avoided this temperature must be considered a maximum.

Obviously toughness can be restored by the original heat treatment, but since most welding repairs of this kind are made to large pieces in the field, further heat treatment is normally out of the question.

A typical analysis of a nickel manganese steel is as follows: carbon, 1 percent; nickel, 3 percent and manganese 12 percent. This alloy has a better resistance to reheating embrittlement than plain manganese steel at temperatures up to 400°C and is often used when subsequent reclamation has to be carried out by welding.

Built up by welding, this crusher jaw was repaired because new jaws were in short supply. Amount of weld metal deposit is in excess of what would normally be considered economical.

Use Arc Welding Only

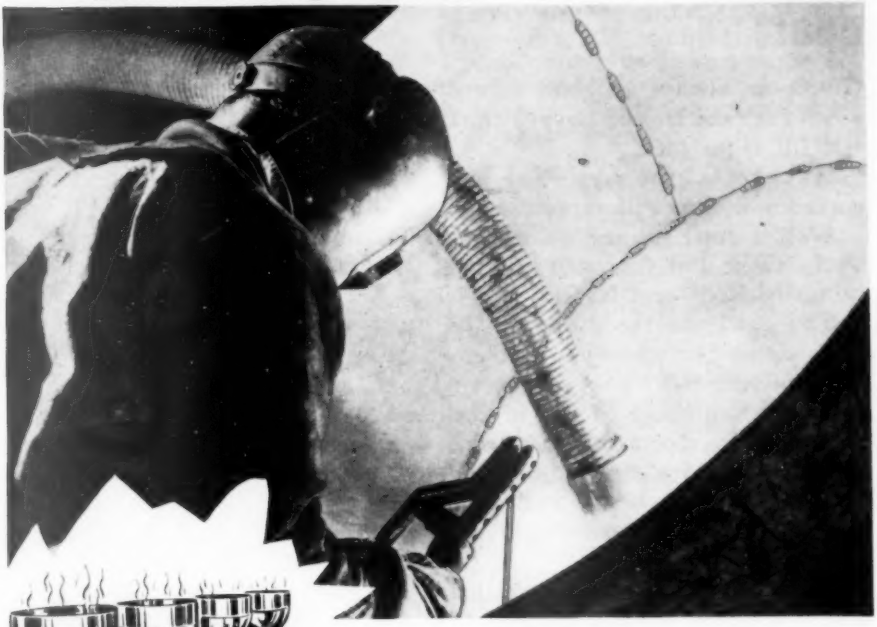
Only the metallic arc welding process should be used for welding these steels, as the heat input must be kept to a minimum. Ordinary types of mild steel electrodes should not be used.

Electrodes recommended are those giving weld metal with 12 to 14 percent manganese, thus matching the composition of commercial manganese steel, and electrodes depositing austenitic stainless steel weld metal containing 18 percent chromium and 8 percent nickel.

The welding of manganese steel should not be attempted with ordinary plain carbon or low alloy steel electrodes because dilution in the junction zone between the

(Turn to Page 73)

ARCOS FOR FINEST QUALITY WELDS



Cooking up some profitable benefits for food processors

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If corrosion resistant welds are essential to the processing equipment you make or use, you'll profit with Arcos. Here's why: Expensive trial-and-error selection is avoided. There's a properly formulated grade for each job. Costly rewelding is eliminated. On *any* corrosion resistant welding problem, get in touch with Arcos Corporation, 1500 S. 50th St., Philadelphia 43, Pennsylvania.

WELD WITH ARCOS

STAINLESS RODS AND ELECTRODES

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I never can tell those Nelson Twins apart

Goldie is always laughin' at me when I see the Nelson boys—I can't tell Jim from Jack.

"It's simple," she says. "You just gotta know their differences."

Well, I can't see the differences in the twins, but you can't mix me up on Ni-Rod® and Ni-Rod "55"®.

You can't see the difference in them either but when you use 'em you can sure tell.

Like I explained to one of the old timers this mornin'—he was usin' Ni-Rod to weld a heavy section of a castin'—

"Pete," I says, "why don't you use Ni-Rod '55' on that job?"

Then he blows up. "What's tha matter with Ni-Rod? I've used it for years, and got darn good results."

"Sure you did," I eases him down, "but just because Ni-Rod is good for most cast iron jobs doesn't mean it is best for all jobs."

"Well, then how do I tell which to use?"

"You use Ni-Rod '55' for heavy sections like this one you're working on, and high phosphorous irons."

"Why Ni-Rod '55'?"

"Because its core is a combination of nickel and iron and that just naturally makes it better for these jobs."

"Where do I use Ni-Rod, then?"

"Ni-Rod is tops for lighter gauges and where a real slick machining job has to be done afterwards."

"How about some of the special kinds like Ductile Iron and Ni-Resist®?"

"Ni-Rod '55' is your best bet there too, an' it's better for weldin' high strength cast irons and for weldin' cast iron to other metals."

Then he asks, "But, is it easy to machine?"

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"Sure is," I says. "An' the weldin' procedure is pretty much the same. Usually you don't need preheat or postheat and both work on A.C. or D.C. An' either one will give you a stable arc in all positions. You always get a smooth bead, wash, an' easy slag removal."

"Well, then you might say, Ni-Rod '55' is a companion electrode to Ni-Rod?"

"That's about it," I says. "Both are dependable and easy to use. It's just a case of determinin' which rod is best for the job."

Well, that just goes to show you, you gotta know the difference—an', by the way, if any of you fellas have any questions about whether to use Ni-Rod or Ni-Rod "55" on a particular job, or if you have a special weldin' problem, you can always get in touch with me through Inco's Technical Service Section.

An', if you haven't already got 'em, write for your copies of "Ni-Rod, an Electrode for Any Cast Iron Welding," and "Ni-Rod '55'."

Yours for better welds,

Nick Rodder

THE INTERNATIONAL NICKEL COMPANY, INC.
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weld and parent metal will result in poor mechanical properties.

Similarly the "manganese steel" electrode should not be deposited directly on carbon or low alloy steels, since resulting formation of a martensitic zone at the weld junction will cause spalling to occur in service.

Before making "manganese steel" electrode deposits on manganese, plain carbon or low alloy steels, a "buffer" layer of austenitic stainless steel must be used to complete the weld.

Remove Work-Hardened Material

Work-hardened manganese steel is embrittled more rapidly than manganese steel in the unworked condition. Therefore, work-hardened material should be removed by grinding or by oxy-acetylene cutting before welding. If grinding is employed, final grinding pressure should be light in order to avoid the reworking of the prepared faces. A quick test for work-hardening is by use of a center punch. A deep indentation should be readily produced in non-worked material.

The use of a small magnet provides a reliable method of detecting and assessing the condition of manganese steel. Fully heat-treated manganese steel is weakly magnetic.

Welding procedure consists of keeping arc time down to minimum periods, using as low a current as possible, using smallest electrode diameter consistent with good welding and keeping arc length short. These recommendations are made to assist in keeping heat input down.

Photos and data courtesy Fox Photos, Ltd., and Murex Welding Process Ltd., London, England.

Resistance Welding Joins TANTALUM To Itself and Other Metals

By JOHN D. KLEIS
Research Physicist and Assistant Director of Research
Fansteel Metallurgical Corporation

DESPITE its very high melting point (5425°F) tantalum is readily welded to itself and a number of other metals by resistance welding. Properly made welds are as strong and ductile as the parent metal.

With tantalum, special care should be taken as to cleanliness and freedom from waves, bends or wrinkles in the metal in the region of the welds. Tantalum surfaces can be cleaned with acetone, carbon tetrachloride or any of the common degreasing solvents. If the metal is especially dirty, it can be cleaned with a mixture of sulphuric and chromic acid, thoroughly washed and dried.

Almost any of the common types of welders can be used—either the transformer or the stored energy type. The welding heads should be of the low inertia type so that as the welds are made, proper pressure will be maintained during the welding cycle. When transformer type welders are used, they should be connected to a primary a-c source where voltage can be expected to remain quite constant, preferably voltage controlled.

When welding tantalum of thicknesses of 0.004 to 0.006 inch, a current density of about 85,000 amperes per square inch of electrode surface, measured at the point of contact with the tantalum, is desirable. A welder of at least 2 kw rating should be used, with open-circuit voltage of 1.5 to 2.0 and closed circuit instantaneous voltage of about 0.75. Conductors in the welding circuit should be sufficiently heavy to assure a current flow of about 2000 amperes even when the equipment is warm. All these values should be increased when welding metal of greater thicknesses.

Spot welds can be made in air when timing is held to one cycle or less. When timing is longer, seam welding and spot welding are done with the work submerged in water. This is necessary to prevent oxidation of the tantalum which would otherwise result in embrittlement.

Copper electrodes or seam welding wheels may be used, but electrodes of RWMA Class 1 alloys are more satisfactory. For electronic tube parts, where removal of copper residues picked up from the electrodes may be difficult, tungsten or tungsten-faced electrodes are recommended.

ABOUT THE PHOTO

Seam welding of 0.015-inch thick tantalum condenser tube is done under water to prevent oxidation which would cause embrittlement.

A common error is to apply too much pressure when welding tantalum. This results in so little resistance at the weld area that no weld is made. The remedy: lighter pressure.

What is Tantalum?

Tantalum is an elementary metal (not an alloy) noted particularly for its immunity to chemical attack

(Continued on Page 106)

RACO gives you UNINTERRUPTED

COSTS NO MORE ... SOMETIMES LESS

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ALUMINUM • BRONZE • SPECIAL PURPOSE ALLOYS
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THREADWOUND COILS
WIRE ON SPOOLS • CATCHWEIGHT COILS

STRAIGHT LINE FEED OFF—Threadwound coils assure straight line feed off. Final reduction to finished size is made on rewinding machines. All butt welds are pulled through finishing die eliminating bumps, kinks and cross overs. All coils have a cast placed in them with a four-inch maximum expansion . . . coils stay in place when tie bands are cut, avoiding looping over sides of pay off reels.

STEEL BANDS STIFFEN COILS—Threadwound coils are now being wound on corrugated steel bands for added stiffness.

UNIFORM WEIGHT—Threadwound coils are of uniform weight, automatically controlled by our rewinding machines.

PALLETIZED CARDBOARD CARTONS—Threadwound coils are packaged in cardboard containers, then steel strapped on pallets manufactured in our own plant.

ENDS OF COILS—Back end of each coil is securely anchored to corrugated steel band . . . starting end is marked with colored tag and left straight for feeding automatic machines. No cutting or straightening needed.

ALL COPPER-COATED WIRE IS ELECTRO-PLATED

MODERN MANUFACTURING FACILITIES—We have complete and modern continuous wire drawing equipment, descaling and acid cleaning for hot-rolled wire rod. Annealing and normalizing equipment. We have fourteen wire straightening and cutting machines, and can furnish straightened and cut lengths up to 36", in sizes 1/32" to 5/16". Catchweight coils up to 400 lbs. Threadwound coils in all standard widths and I.D. . . . all standard size spools.

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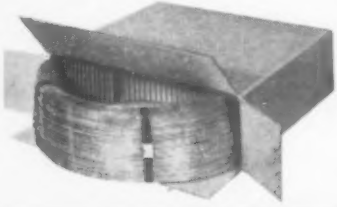

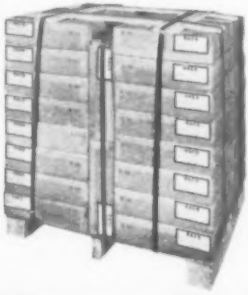

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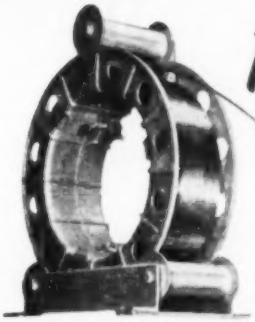

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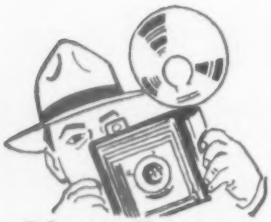


Photo Feature

Do you want to fabricate stainless steel weldments efficiently and economically? Follow these nine suggestions and obtain . . .

Trouble-Free Welding of STAINLESS STEEL

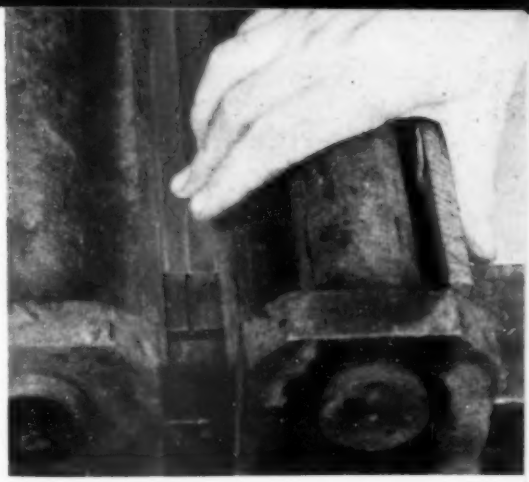
YOU CAN weld or solder stainless steel with same equipment used for carbon steel. This means metallic arc, inert arc, oxy-acetylene and resistance welding processes can be used.

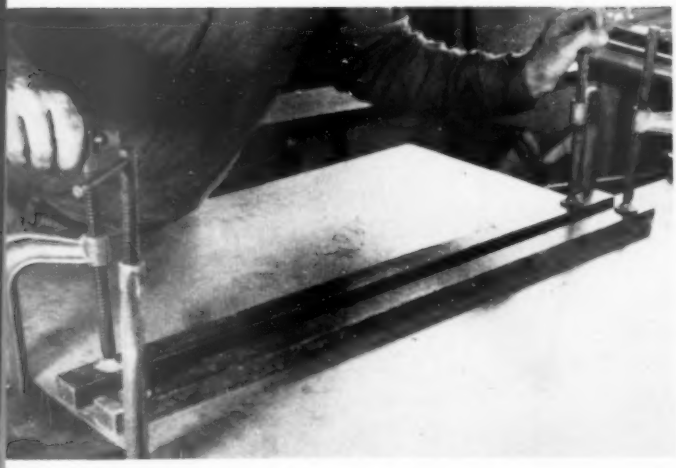
But, like any other metal, stainless has special characteristics that must be considered and certain precautions that must be observed during fabrication. This pictorial presentation has been prepared by Armco Steel Corp. to help recognize those factors.

WELDING REFERENCE TABLE

	Rod Size Diam. Inches	Edge Spacing	Type of Rod	Flux
OXY-ACETYLENE 18 gage and lighter 18 to 16 gage 16 to 10 gage 10 gage to 3/16 inch 1/4 inch and heavier	1/16 1/16 to 3/32 3/32 to 1/8 1/8 to 5/32 5/16 to 1/4	On 22-gage and lighter, use flange butt. 16 through 20 gage, butt edges. 14 gage and heavier, space sheets metal thickness apart.	Bare (Uncoated)	Flux required. See Mfrs. recommendations for Oxy-Acetylene welding of stainless.
METAL ARC 20 gage 18 gage 14 gage 1/8 inch	1/16 5/64 3/32 1/8	ON BUTT WELDS, 18 gage and lighter, butt the edges. Heavier gages, space metal thickness apart.	Coated Rods	Use flux-coated rods
INERT GAS-SHIELDED ARC	Where needed, use rods about equal to metal thickness.	Usually butted. Lighter gages may be flange butted.	Not usually needed. If so, use bare rods.	None

1 Welding stainless is different from mild steel. For example, Type 302 has 50 percent more heat expansion and only one-third the heat conductivity. Welds made in stainless are stronger, more ductile, but must be held by jigs during welding.



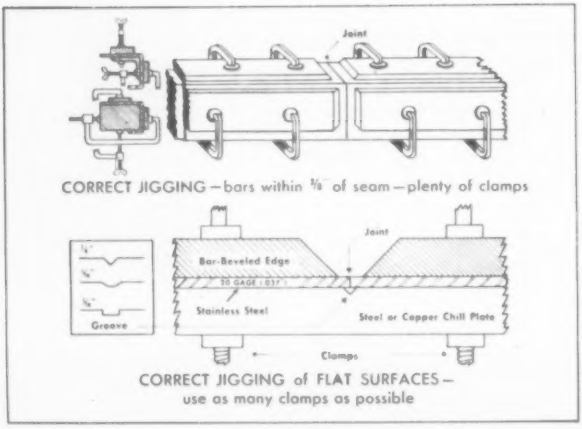


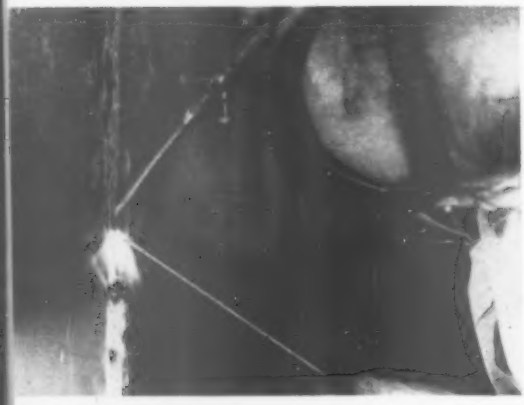
2 Use heat-dispersing jigs in all stainless welding. They are needed to align parts properly, prevent distortion and remove excess heat. This is important with Type 430, even though it expands less than Type 302.

3 Simple, inexpensive and effective welding jigs can be set up in any shop. Equipment like this will handle most jobs. You'll need steel or copper chill bars about ½-inch thick, some angles and a few strong "C" clamps.

Trouble-Free Welding of Stainless Steel . . .

4 Drawings show correct positions of clamps and bars for welding stainless. Keep chill bars close to weld zone — not more than 3/8-inch from the joint. Bars with beveled edges allow more space to work. Use plenty of clamps.





5 Oxy-acetylene welding causes more distortion than other methods. With 14 gage or heavier, joint spacing should equal thickness of the metal. Use butt joints on 16 through 20 gage; flange butt weld on 22 gage and lighter.

6 Metallic arc welding is used on stainless sheets 20 gage and heavier. On 20 through 16 gage, butt edges tightly. On heavier gages, space edges about metal thickness apart. Coated electrodes are best. Keep arc short.

(Turn to Page 82)

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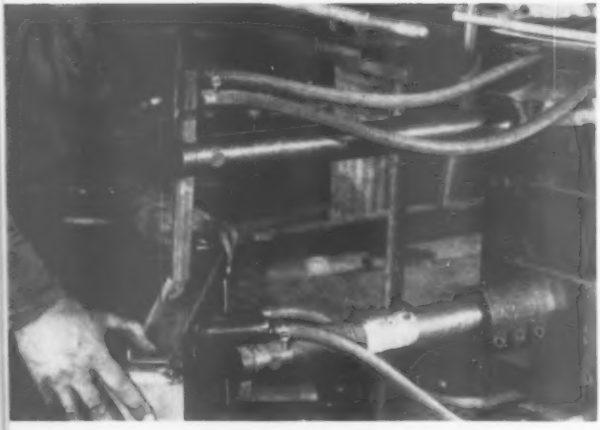
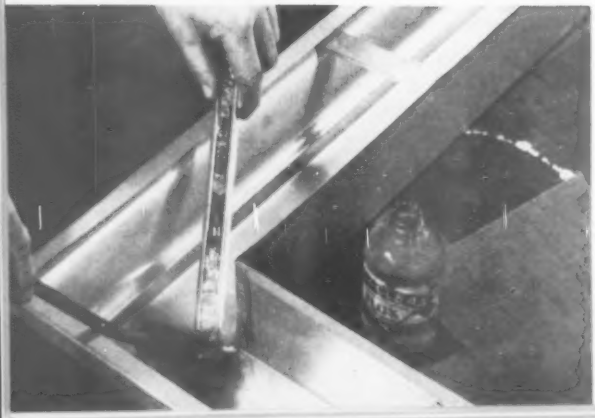
Trouble-Free Welding of Stainless Steel . . .

7 Inert arc welding is excellent for stainless up to ¼-inch thick. Filler rods are not usually needed; torch uses tungsten electrodes. Edges are butted and fused. Small, clean beads keep finishing costs low.

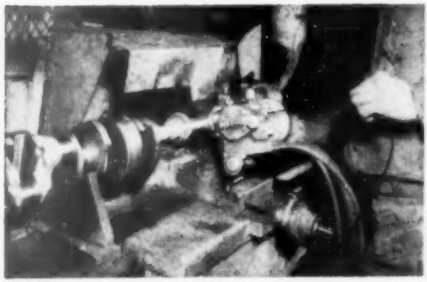


8 Low heat input makes spot welding excellent where lapped joints are permitted. Works best with high welding pressures at low heat and short weld timing than is used for a comparable cold-rolled steel sheet thickness.



9 Before soldering, roughen joints with emery paper or abrasive wheel so flux will wet surface. Clean and apply stainless flux. Coat edges with thin film of solder. Apply solder with large iron, quickly flowing solder into the joint. For strong joints, solder should be at least 50 percent tin. Remove excess acid. Use ammonia water, cleaning solution, then scrub clean with clear water.

when mistakes happen...



Automotive crankshaft being brought up to inspection standards with metallizing. This automotive manufacturer formerly used plating for this type of salvage, worked one per hour. With metallizing, the salvage operation requires only 5 to 10 minutes per shaft, including surface preparation.

...and they do in any busy machine shop, there's no need to scrap a mis-machined or otherwise damaged machine part that represents an investment of many expensive man-hours.

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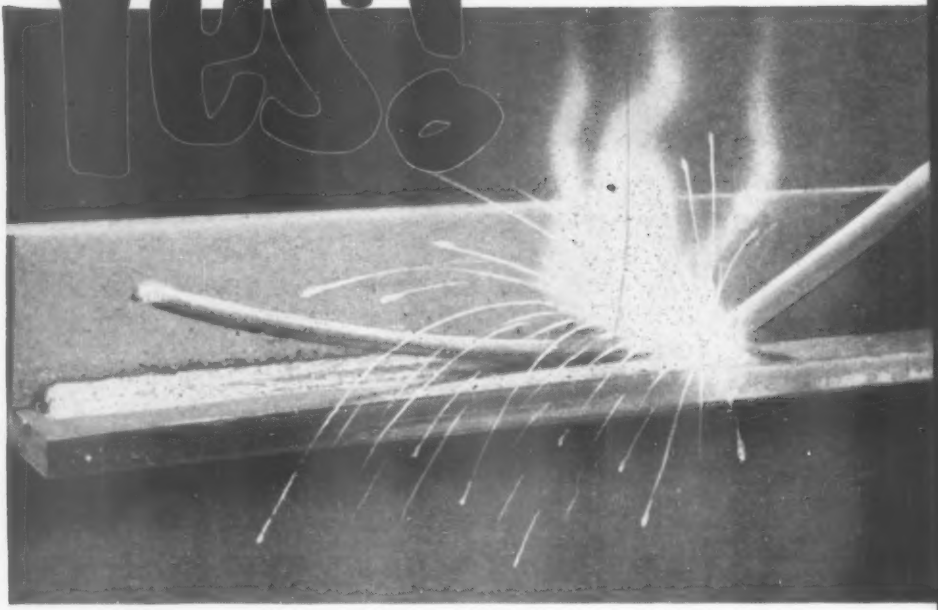

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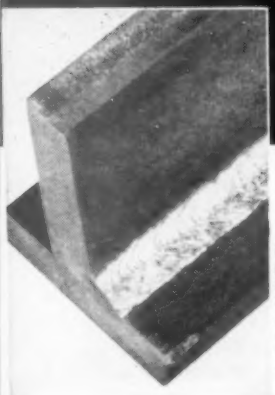

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Welding of copper-base alloys presents few difficulties that cannot be overcome. All that is required is proper welding techniques, correct joint preparation and back-up, sufficient preheat and an understanding of metallurgical changes that may take place when welding a specific alloy. Here's the complete story on . . .

Weldability of COPPER-BASE Alloys

THERE ARE a large variety of copper base alloys which range from the very soft and ductile pure copper to those that obtain their hardness and high strength through the medium of a heat treatment. Due to this variance in chemical composition and different metallurgical response to welding procedure, it is necessary to choose a specific welding procedure to obtain satisfactory weld joints. This choice of welding procedure is based on such factors as, (a) the corrosion resistance that is required in the weldment; (b) the size, shape and joint design of the item to be welded; (c) the resultant metallurgical and physical properties obtained in the weldment and their relationship to the specific welding procedure that has been chosen; and (d) the available welding and jigging equipment.

Copper Compared With Mild Steel

In comparison to mild steel, the copper base alloys have appreciably higher coefficients of thermal expansion, thermal and electrical conductivity. In addition, they exhibit lower melting points and greater fluidity at the welding temperature. These facts indicate that a variation in technique in fusion welding copper would include the following results;

(a) the high rate of thermal expansion would preclude increased precautions to prevent excessive warpage and stresses. In most instances, a greater space within the joint is required to allow for expansion.

(b) the use of tack welding more frequently than that required in welding mild steel so as to maintain alignment, reduce warpage and stress to a minimum.

(c) due to the high thermal conductivity of these alloys, the use of back-up bars are often required.

(d) the use of higher pre-heats is essential since these materials not only require a greater heat input, but also require a short welding time to minimize possible vaporization of alloys within the alloy composition.

(e) the use of higher amperage in an arc welding procedure for equal size electrodes and plate thicknesses.

(f) a higher rate of welding speed in depositing the weld bead.

Properties Influence Techniques

Where resistance welding is to

The first in a series on welding of copper-base alloys, this article will be followed by other articles on fabrication of copper-base alloys by metallic and inert arc, oxy-acetylene and resistance welding processes.

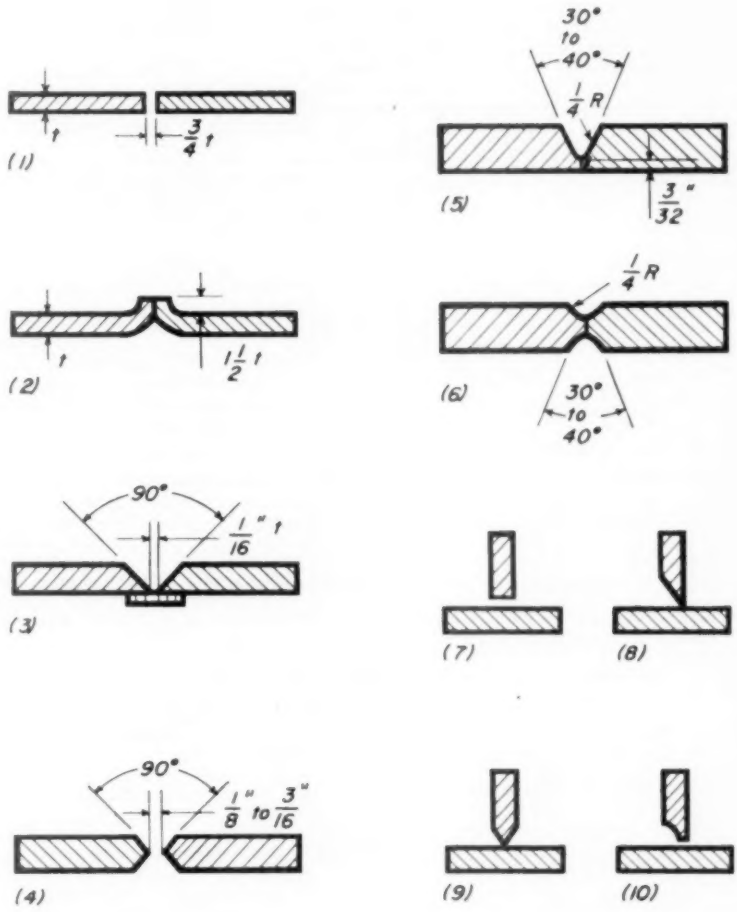

FIGURE 1. These joints are employed in the fusion welding of copper-base alloys. Note that wide grooves are used and sharp corners are avoided.

TABLE 1 COPPER AND COPPER ALLOY ELECTRODE CLASSIFICATIONS

Core Wire Type	Proposed AWS - ASTM Designation	Deposit Composition Per Cent	Available Form	Application
Deoxidized Copper	E Cu	Copper - 99.0	Coated and Bare	Oxyacetylene, metallic arc and inert arc welding of deoxidized copper.
Phosphor Bronzes	E Cu Sn-A	Tin - 5.0 Phos - 0.3*	All are Coated or Bare	Metal-arc welding of deoxidized copper, low and high brass, phosphor bronze; carbon arc welding of phosphor bronze and copper.
	E Cu Sn-C	Tin - 8.0 Phos - 0.3*		Carbon arc welding of electrolytic tough pitch copper, deoxidized copper for single pass welding; metal-arc welding of phosphor bronze.
	E Cu Sn-D	Tin - 10.0 Phos - 0.3*		Carbon arc welding of electrolytic tough pitch copper, low brass for single pass welding, phosphor bronze; oxy-acetylene welding of phosphor bronze.
Silicon Bronze	E Cu Si	Silicon - 3.0 Copper - 94.0**	Coated and Bare	Carbon arc welding of deoxidized copper, low and high brasses, silicon bronze; metal arc welding of deoxidized copper and silicon bronze; inert arc welding of deoxidized copper, low and high brasses, silicon bronze, phosphor bronze and cupro-nickel; oxy-acetylene welding of deoxidized copper, silicon bronze and low brass.
Aluminum Bronzes	E Cu Al-A	Alum. -7.5/9.0 Iron 1.5*	Coated	All procedures in welding aluminum bronze; metal arc welding of the brasses.
	E Cu Al-B	Alum. -9.0/10.0 Iron - 3.0/5.0	Coated	All procedures in welding aluminum bronzes.
	E Cu Al-C	Alum. 10/11 Iron 3.0/5.0	Coated	All procedures in welding aluminum bronzes.
	E Cu Al-D	Alum. 11/12 Iron 3.0/5.0	Coated	All procedures in welding aluminum bronzes.
	E Cu Al-E	Alum. 12/13 Iron 3.0/5.0	Coated	All procedures in welding aluminum bronzes.
Cupro Nickel	E Cu Ni	Nickel - 30.0	Coated	Metal arc, inert arc and oxyacetylene welding of the cupro nickels.

*Maximum **Minimum Note: Remainder copper unless otherwise specified.

be employed, the properties of the copper base alloys have a decided influence upon the technique. Thus, the electrical and/or thermal conductivity of these alloys can be used as a gage in determining their relative weldability in an inverse ratio; this also being the gage in determining the secondary current that is required; the welding pressures employed are lighter than that used for mild steel; in some instances, as in the case of resistance welding the high brasses, the pressures employed are considerably lighter; and, the welding time is shorter than that used for mild steel.

As in the welding of other materials, joint design for fusion welding this type of material is dependent upon such factors as the thickness of material to be welded, the type of stress application including both the magnitude and method of application of loading and the cost of joint preparation. A few suggested joint designs are indicated in Fig. 1; these joints being employed in the more common methods of fusion welding. However, as previously stated, wider grooves are used and sharp corners are avoided.

Where the thickness of sheet will vary between 1/8 inches down to a low of 1/32 inches in thickness, the joints as indicated in (1) and (2) are more frequently used; these butt joints being particularly suited for one pass welding technique. The upturned butt joint is often used where no filler metal is employed; the upturned edges serving as the joint metal. Where the thickness of material to be welded increases, the joint design that would be selected will be either the single vee, the double vee, the single 'U' or double 'U'. As would be expected, not only will the joint preparation be more expensive, but also, these joint designs will require multi-pass weld-

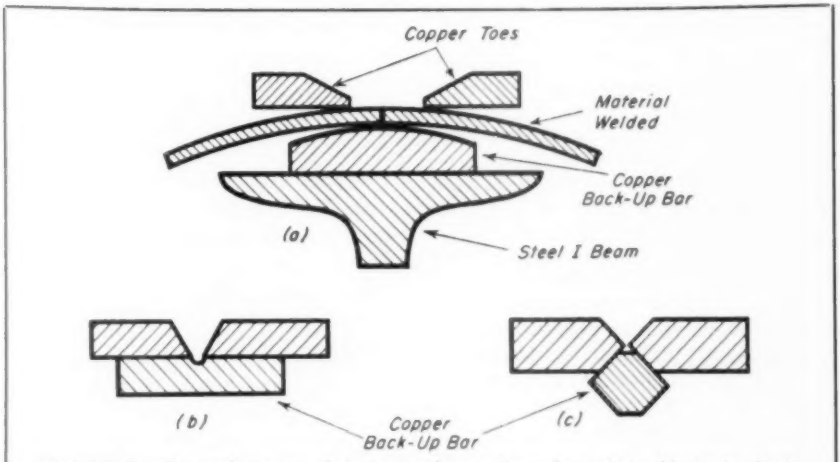

FIGURE 2. Typical set-up (a) is used on alloys less than 1/8-inch thick. Copper back-up bars, (b) and (c), are used to obtain full penetration at the start of welds in heavy plate.

ing techniques. In multi-pass welding, particular care should be taken to chip out part of each weld pass so that a clean surface remains for the subsequent weld deposit.

Thickness Governs Joint Design

As previously mentioned, choice of joint design is dependent to a large extent on thickness of material to be joined. Thus, the single vee type joint is widely used for welding thicknesses from 5/32 to 7/16 inches. Both the double vee and the single and double 'U' joints are used in welding plate that is approximately ¾ inches or over in thickness. It should be remembered that both the root opening and the included angle employed in these joint designs are quite flexible. Sufficient root opening is necessary to allow for the greater expansion experienced with these alloys, and a liberal included angle in the joint design is usually required to minimize the possibility of undercutting, possible slag entrapment and porosity within the fusion zone.

The fillet welds, as illustrated in Fig. 1, are also used to some extent; the choice of joint design also being dependent upon the magnitude and type of stress encountered in the welded joint along with the thickness of material to be welded. Other weld joints commonly employed would be the single and double fillet lap, the flush and half-open corner joint and the edge joint.

Need Proper Weld Back-Up

Successful welding of various copper-base alloys will also depend, to a large degree, on the type of back-up bar or plate that is used. Experience has indicated that electrolytic tough pitch copper is the most satisfactory material available for backing up a weld. The high heat conductivity of such a back up bar or plate will prevent its sticking to the weld metal, while its chill mold effect will assure a clean, smooth weld metal surface. In many instances, standard size back up bars are available; these standard shapes varying in dimensions from 1 to 6 inches in width, 1/8 to 1 inches in thickness and from 6 to 12 feet long. Fig. 2a is a typical set-up used for the arc welding of sheet stock, either copper, silicon bronze, or other alloy types, which is 1/8 inches or less in thickness. The copper insert back-up bar and the copper toes, which are attached to clamping rails, assure a clean, smooth underside of the weld. In addition, there is excellent conductivity for the welding current and less magnetic interference of the arc than when compared to an all-ferrous metal fixture. Figs. 2b and 2c illustrate the manner in which copper back-up bars are used to obtain full penetration at the start of welds in heavy plate.

How To Select Welding Electrode

Although specific welding technique along with electrode material to be used will be given in subsequent articles, it can be stated at this point that the electrodes employed for fusion welding will be, in general, quite similar in composition to the base metal welded. However, there are modifications to this general statement

(Turn to Page 92)

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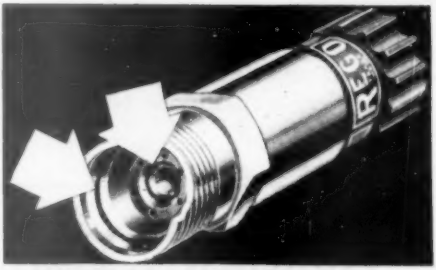

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where a deviation in the choice of an electrode composition is required to obtain a specific property within the weld metal. For reference, a partial listing of the electrode materials available, the suggested usage and the available form is given in Table 1. These electrodes will be discussed in subsequent articles.

An example of where choice of electrode would depend on a specific property desired within the weld metal, is the choice of an aluminum bronze coated rod for metallic arc welding of the various brasses. This choice is due to the excellent corrosion resistance that is obtained in the resultant weld deposit. In addition, high tensile and fatigue strength will be realized.

As previously mentioned, the welding of certain copper alloys, such as the brasses, will result in volatization of the alloying component. Thus, it is essential to provide adequate ventilation to remove resultant fumes. It should also be remembered that fusion welding of the copper base alloys will eliminate any cold working that may have taken place previous to welding.

BRAZING TITANIUM

(Continued from Page 56)

joint could be realized. The various brazing alloys have a hardness "as cast" between Rc 25 and Rc 46. The interface hardness after complete alloying with various alloy combinations varies between Rc 25 and Rc 36. Commercially pure (RC70) has a hardness between Rc18-23.

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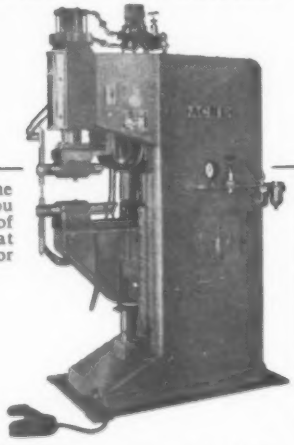

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Approximately 15 different alloy combinations show promise, but only two have been partially evaluated. The series A alloy, experimentally designated A7a, is nickel base. The B series alloy is titanium base and the B4 composition is being used only as an exploratory alloy for this series. Other alloy combinations have only been evaluated as to wettability and effects of time and temperature on flow characteristics.

Preliminary compressive shear on a diameter of 0.532-inches and a depth of 0.144-inches. Failure occurred in the braze joint. Tensile shear data determined on specimens averaged approximately 43,000 psi with the shear area calculated on a diameter of 0.395-inches and a shear length of 0.060 to 0.081-inches. All failures occurred in the parent metal outside the brazed joint. The highest value was 48,000 psi and lowest 37,000 psi.

Compression Test Data

Compression shear data on the B4 alloy averaged approximately 37,500 psi and failure occurred in the braze joint. The highest value was 39,750 psi and the lowest 35,550 psi.

In order to determine whether the time and temperature influenced the base metal RC70, a blank tensile specimen was run which was the same size as the shear test specimen. It was furnaced along with the shear specimens. The resulting tensile strength was 110,000 psi which checked closely with ultimate tensile strength of the received RC70 which was 105,000 psi. The elongation could not be correlated with RC70 data because of the difference in gage length. However, there was appreciable necking down at the fracture indicating that the ductility had not been damaged appreciably.

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Continuous 8-hour welding test demonstrates the extra stamina of the P & H WN-250

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New developments indicate that a helium-nitrogen shielding gas may add new benefits in welding low carbon steel, while retaining all of the other benefits of inert arc welding. Here's how - - -

LOW CARBON STEEL is Welded with the Inert Arc

By Eugene L. Turner and Walter F. Heller

NITROGEN mixed with helium to form the shielding gas for inert arc welding gives promise of significant cost reduction and improved weld quality in the welding of low carbon steel. This was revealed at the Buick-Oldsmobile-Pontiac Assembly Division of General Motors Corp., Kansas City, Kansas, after comparison tests were made using the helium-nitrogen mixture and the widely used helium-argon mixture.

A 50 percent reduction in amperage and lower cost per cubic foot of helium-nitrogen gas mixture were among the improved properties reported for the new method.

Nitrogen has an important effect upon the electrical behavior of the welding arc. In any welding arc, the temperature of the positive column is determined by several conditions, namely, (a) arc current, (b) heat conduction and convection properties of the arc atmosphere and environment and (c) the effective ionization potential of the arc gases.

A change in any one of these factors produces corresponding changes in the voltage gradient and arc-column diameter, such that the heat produced in the arc is equal to that transferred to the arc environment. Increasing the heat-transfer ability of the arc atmosphere reduces the arc-column diameter and increases the temperature and voltage gradient in the arc column.

BEND-TEST RESULTS

Helium-Nitrogen—Butt Welds			
Sample No.	1	2	3
Fracture	No fracture in weld	No fracture in weld	No fracture in weld
Helium-Argon—Butt Welds			
Sample No.	1	2	3
Fracture	No fracture in weld	1/8-in. fracture in weld	Fracture across weld

Table I—Results of the bend test on three sample welds made with each gas mixture. Specimens, 1 in. by 6 in., were cut from 6 in. by 6 in., 0.125-in. low-carbon steel plates butt welded together.

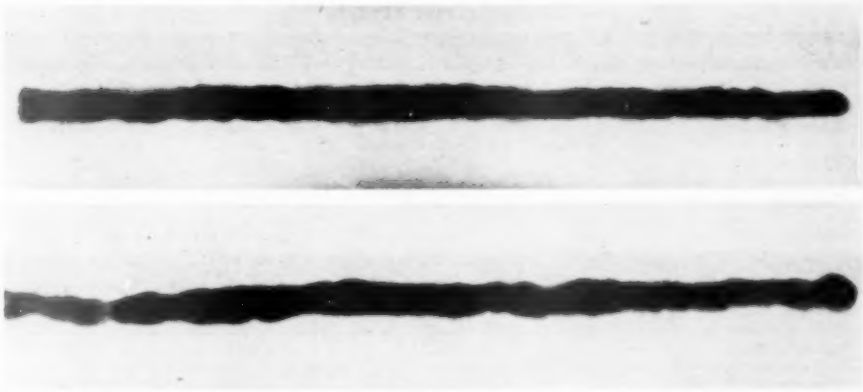


FIGURE 1. (Top) X-ray of weld made using helium-nitrogen gas mixture shows a freedom from gas pockets, heat cracks and other welding defects. (Bottom) X-ray of weld made using helium-argon mixture indicates presence of heat cracks at the beginning and end of welds with scattered gas pockets.

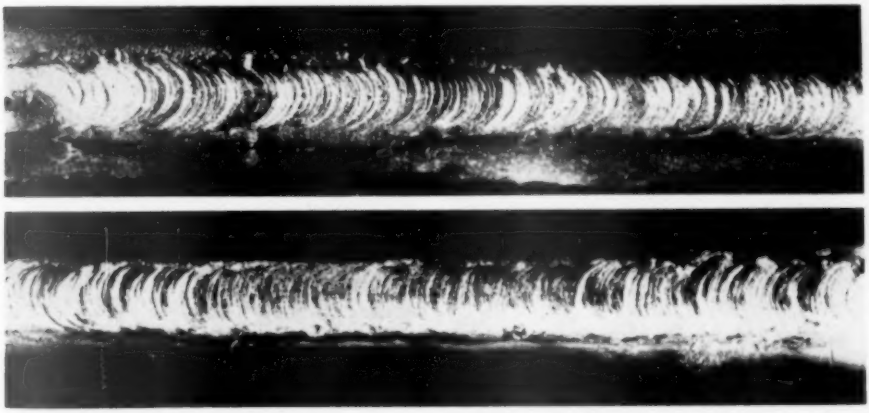


FIGURE 2. Comparison of fillet welds indicates no apparent differences in the microconstituents of the weld produced by the two gas mixtures. (Top) A weld made using helium-nitrogen mixture. (Bottom) Weld made with helium-argon.

Nitrogen is a diatomic gas. Like most diatomic gases, when present in the arc atmosphere it is completely disassociated at arc temperature. The recombination of single atoms to form diatomic gas molecules results in the liberation of heat to the arc atmosphere, increasing its heat-transfer ability. Thus, the arc temperature and voltage gradient are increased while the current is decreased.

Make Comparison Tests

In tests made at the Kansas City plant of the B.O.P. Assembly Division, identical joints were weld-

TENSILE-TEST RESULTS

Helium-Argon Specimen No.	1	2	3
Area	0.0928	0.0927	0.0927
Ultimate Load	4,250	4,250	4,165
Ultimate Stress (psi)	45,750	45,800	44,990
Elongation (per cent in 2 in.)	30.5	30.5	30.5
Location of Fracture	Out of Weld	Out of Weld	Out of Weld
Helium-Nitrogen Specimen No.	**1**	**2**	**3**
Area	0.0927	0.0927	0.0929
Ultimate Load	4,250	4,250	4,115
Ultimate Stress (psi)	45,510	45,510	45,340
Elongation (per cent in 2 in.)	30.5	30.5	30.5
Location of Fracture	Out of Weld	Out of Weld	Out of Weld

Table II—Summary of tensile-test data comparing three weld specimens, 1 in. by 10 in., 0.125-in. low-carbon steel.

ed using the two different gas mixtures. Butt welds and fillet welds in the form of T-joints were made, using 0.125-inch low carbon steel. The steel was in the "as sheared" form with no attempt made to remove burrs, rust or oil. Preparation of the joint was limited to tack welds at the ends of the fillet-weld joints and at one end of the butt-weld joints.

Better Weld Quality

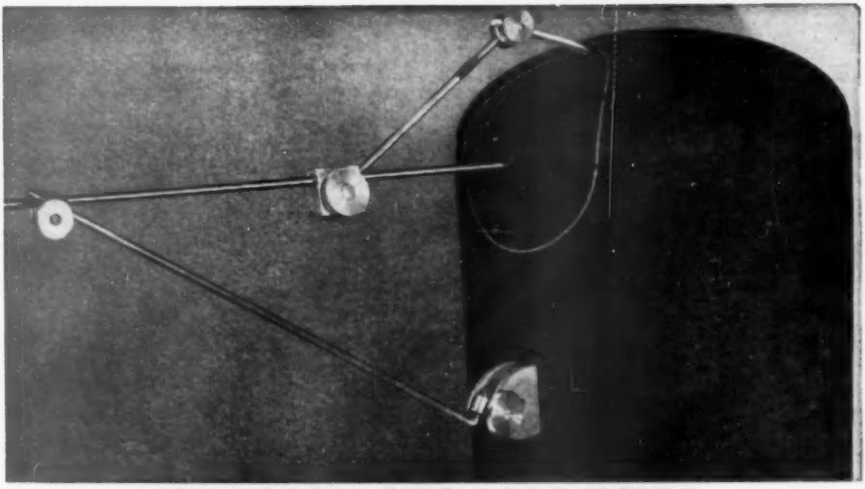
The tests of the helium-nitrogen and helium-argon weld specimens compared the following five characteristics: ductility, micro-structure, hardness, tensile strength and fatigue.

Bend test was made on weld samples 1 by 6-inches cut from 6 x 6-inch plates which had been welded together from one side only. Test samples from both types of mixed gas were polished and bent in the weld 180° over a diameter twice the thickness of the welded plates (0.250 inches). The side of the weld on which the metal was deposited was on the outside of the bend on this test. Table I shows that two of the samples of helium-argon butt welds fractured. On the other hand, none of the samples of helium-nitrogen butt welds showed fractures, indicating that helium-nitrogen welds have better ductility than helium-argon welds.

Make X-Ray Tests

The presence of heat cracks and gas pockets in the weld was studied by radiographs. Both butt-weld and fillet-weld test plates were examined before being cut for further testing. The weld made in the helium-nitrogen mixture indicates a freedom from gas pockets, heat cracks or other welding defects. The helium-argon test welds contained heat cracks at the beginning and end of welds with scattered gas pockets throughout.

The possibility that the new gas mixture might result in formation of undesirable nitrides, which tend to cause embrittlement of the weld,



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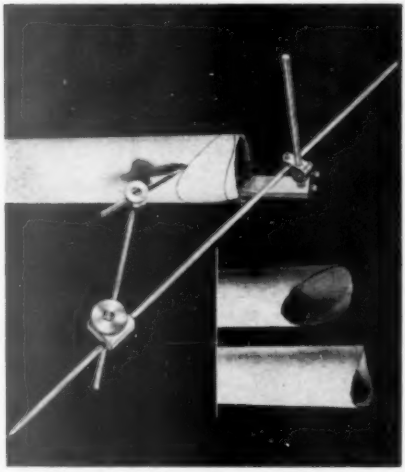

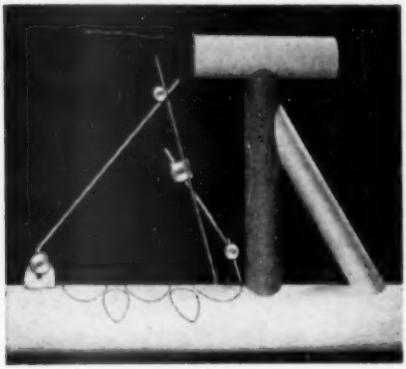

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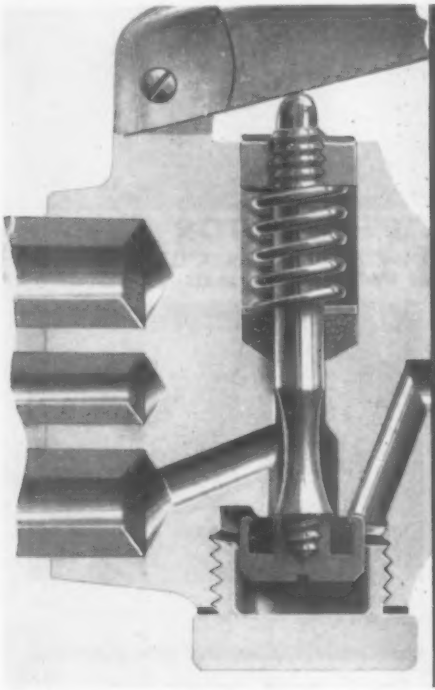

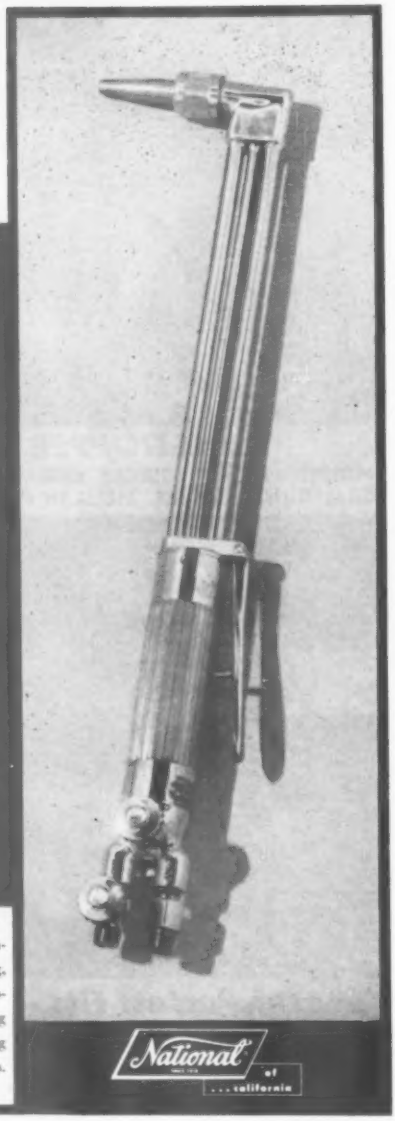

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also was a consideration in these tests. Examination of the microstructure of cross sections from each type of weld was made using either nital or pical etchants. No significant difference in the microstructure of the two types of weld could be found. Both were typical of low carbon steel welds.

Another test using ferricyanide etching solution to differentiate between nitrides and carbides was attempted. This produced no results since etching of the surface did not occur.

Make Other Tests

Hardness reading taken on the test-weld cross section were 81 Rockwell-B for the helium-nitrogen welds and 78 Rc-B for the helium-argon weld. This was not considered a significant difference in hardness which could be attributed to the gases used.

Metallographic examinations indicated no apparent difference in the microconstituents of the welds produced by the two gas mixtures.

The fatigue properties were tested with weld samples 3-inch by 10-inch cut from the plates. Compression stresses and tension stresses were equal. The results showed a scatter band of values and no conclusive fatigue-test summary could be reached to show any superior fatigue property of one weld over the other.

Neither gas mixture appears to have any superiority over the other in affecting the tensile strength.

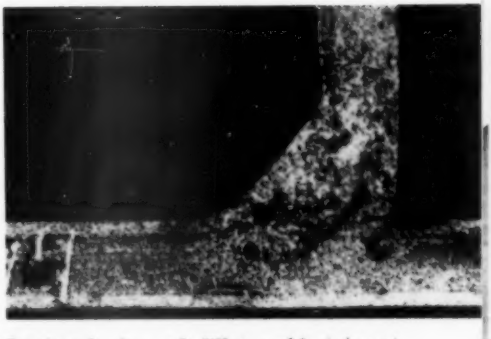
Reduction in Cost

In addition to the above physical properties of the welds made with the helium-nitrogen shielding-gas mixture, four important cost savings were determined from the test.

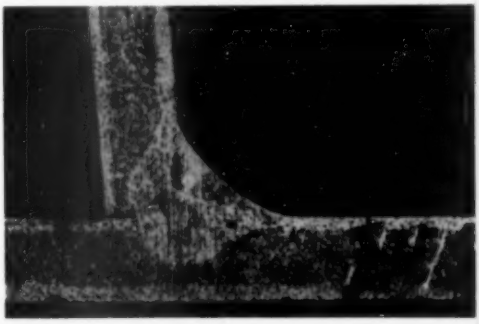
Welding current reduction was 50 percent.

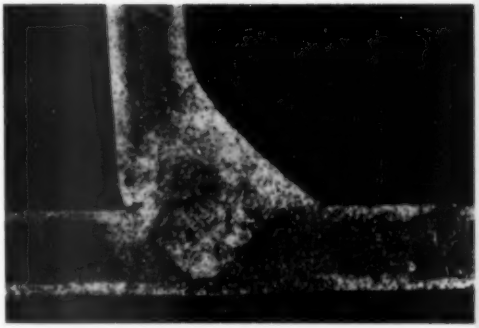
Lowered gas consumption also

(Continued on Page 105)



Sectional view of fillet weld (above) shows penetration obtained using argon gas as the shielding medium. Similar penetration is obtained in fillet weld (below) when helium-argon mixture is used as shielding gas.





Slight improvement was noted in this fillet weld when helium-nitrogen gas mixture was used.

Are Welding Codes Too Strict? . . .

Continued from pages 62 and 63

Lincoln Says Yes . . .

Every day we see riveted joints which are made tight by caulking. This is a standard accepted process. The resulting undercut is enormous yet a welding undercut that is almost infinitesimal in comparison is frequently made the reason for rejecting welds.

The contour of the deposit of the weld is a matter of close inspection but no one examines the contour of any rivet or the hole it may only partially fill.

Insured vessels must have their welds X-rayed, and we see welds chipped out and rewelded because of trifling porosity, yet no one X-rays a riveted joint.

The same thing is true of many other structures outside of insured vessels.

Any excess strain placed on the welded structure will distort the rest of the structure and render that structure valueless for its intended purpose long before the weld would fail. Yet such testing and rejecting is made mandatory in many structures but, of course, never in riveted structures.

Castings, both steel and gray iron, are rarely required to be X-rayed, yet from the material of the castings, it is well known that many hidden defects are present.

Over the forty years since arc welding has been in commercial existence it has consistently done a more reliable job than rivets or castings. In spite of this experience, the engineering profession continuously requires these excessive and uneconomic tests and requirements.

This continued suspicion of the engineering profession toward welding, in spite of its enviable record, does not reflect credit on the profession.

It is high time that welding be given its proper place in manufacturing methods, without restrictions which are harmful. This will save the consumer hundreds of millions of dollars each year in lower cost of present structures and the making possible of a tremendous number of other structures now eliminated by these impractical and unscientific rules.

Very truly yours,
J. F. Lincoln
Chairman of the Board Lincoln Electric Co.

Mutual Boiler Says No . . .

leads to stress concentration and which may produce stresses far above those deemed safe.

A review of the failures that have occurred in boilers and pressure vessels over the years they were constructed with riveted butt joints will disclose that very few were caused by the failure of the riveted seam. There have been, of course cases where caustic embrittlement cracking took place and the cracks extended from rivet hole to rivet hole, causing failure, but this does not condemn this type of joint.

In the riveted joint we could have several types of failure but the structure would not necessarily fail while in a welded joint a complete failure in this small area would cause complete failure of the unit.

We do not agree with Mr. Lincoln's statement that riveted joints are not inspected and that the rivet holes are not examined. There are definite rules and procedures in the Code that have to be followed in the shops where riveted joints are made. Riveted seams are inspected in a fabricator's shop in

(Continued on Page 104)

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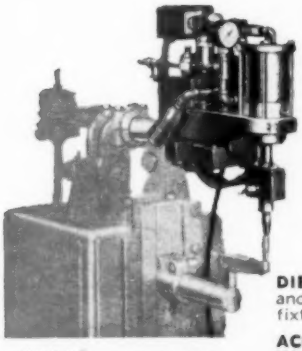

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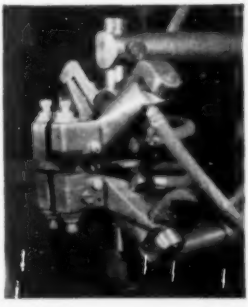

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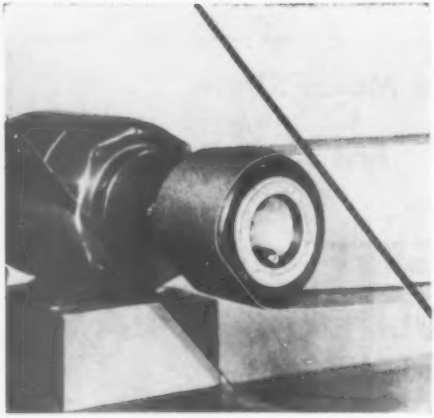

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accordance with a given procedure the same as welded seams are inspected in accordance with another procedure.

Mr. Lincoln shows pictures where several types of failures occurred but they always occurred in the solid plate and the welds did not fail. We also have records of where welds failed and recently we had three longitudinal welded seams crack for a length of over 100".

We also recall another case where a man had been welding for several years on low pressure work and it was decided to have him weld on high pressure steam piping. Everyone was confident that the man could weld properly but it was decided to give him a test in accordance with ASME Code requirements. The welded specimens were prepared for testing and, while handling them prior to the testing, one was accidentally dropped on the floor and it broke in half. The remaining specimens were broken by hand and the testing jig was not required.

Mr. Lincoln states that expensive and impractical tests are being written into specifications retarding the progress and application of welding. We do not know the tests to which Mr. Lincoln refers; certainly the procedure and quality tests are neither extensive nor expensive.

Welding has made tremendous strides in recent years and the Lincoln Company has been one of the outstanding contributors. As for example, Lincoln devoted seven years to the development of their new E6020 "Jet Weld" in the interest of and for the benefit of the welding industry. Its use for pressure and structural work is spreading by leaps and bounds.

In summary we are in general agreement with present-day Code

requirements and restrictions with respect to welding. We particularly believe these requirements are necessary in some of the smaller fabricating shops. There must be some measure of quality control.

We hope that these comments will be of some value to you in any reply that you may make to Mr. Lincoln.

Cordially yours,
C. L. Keene
Vice President—Engineering

LOW CARBON STEEL

(Continued from Page 101)

was a result since a decrease in amperage in inert arc welding brings a decrease in gas flow. Ratio of the cost per cubic foot probably varies, depending on the location and the availability of supplies.

A 1/6-inch filler wire was used with helium-nitrogen gas for single-pass fillet or butt welds. This is a savings in filler material over the 5/64-inch or 3/32-inch filler wire normally used with helium-argon gas.

Greater welding speed and a smaller, cleaner bead were other results obtained. The faster, forehand welding technique was used for fillet welds making possible large concave beads. Undercutting was eliminated because the helium-nitrogen welds permitted good weld-metal wetting action, resulting in a minimum restriction in the flow of weld metal up the sides of the fillet legs.

The backhand technique restricts the welding operator's view as to the direction of travel since the unwelded portion of the joint lies directly in front of the arc.

The smaller bead in a production application means that less grinding is required.

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Operating speeds from 850 to 12000 RPM in famous *Strandflex* 4 & 5-Speed Gear Drive Machines, up to 1 HP. Change speeds without using tools. Also, Strand High Speed Gear Attachment increases speeds up to 27000 RPM, suitable for high speed steel or carbide cutters.

Best of all—the operator lifts the tool only, not the heavy bulky motor. This means less fatigue, higher production, fewer rejects.

FREE CATALOG describes full Strand line of Flexible Shaft Machines. See your Distributor or write today for Catalog 631-A.

FRANKLIN BALMAR CORPORATION
N. A. STRAND DIVISION
Woodberry, Baltimore 11, Maryland
5001 N. Wolcott Avenue, Chicago 40, Ill.

Circle No. 69 on Reader Service Card.

TANTALUM . . .

(Continued from Page 75)

by almost all acids. It is used extensively in the chemical industry for processes where freedom from acid corrosion and high heat transfer efficiency are desired. Heat exchangers, coolers, condensers, absorption plants and other equipment are commonly made of tantalum, and resistance welding is employed in the fabrication of almost all of this equipment.

Structural Uses

In the metal working industry, tantalum is used in the form of coils or bayonet heaters for heating acid pickling or plating solutions. More recently, tantalum has come into use as structural members for holding parts in anodizing and electropolishing solutions.

In the electronic field, tantalum is used for anodes, grids and cathodes in high quality, special purpose power tubes. Its easy fabrication and excellent electronic properties make it an ideal material for vacuum tube parts.

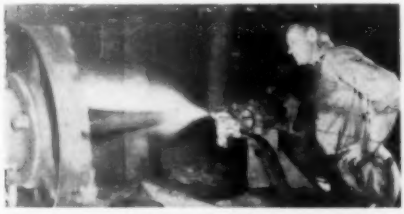
The tensile strength of tantalum is about the same as that of mild steel: 50,000 psi for annealed sheet and up to 110,000 psi in cold worked form. Its hardness is from 60 to 95 on the Rockwell E scale.

Tantalum is worked cold. Even at dull red temperatures, tantalum begins to combine with surrounding gases, except the noble gases such as argon or helium. All forming operations are done cold, and when welding, as previously noted, protective surroundings must be provided except for short time spot welds on very thin sheet.

Circle No. 180 on Reader Service Card for Further Information

Life of Rods Increased 300% by Metallizing

A leading manufacturer of diesel, gas engines and compressors, in business over 100 years, is quite up-to-date in it ideas and processes. Among its varieties of heavy duty compressors is a type used widely in chemical plants and pipeline installations where gases are often highly corrosive, due to the presence of sulphur or other elements, making maintenance a definite problem. Since the rods must be



This rod is 4' 8" long, 3" diameter. The procedure is to undercut a portion of the shaft. Threads are then prepared with a special tool and the surface metallized with stainless steel.

operated without lubrication to prevent contamination of gases, galling and subsequent damage to the packing frequently occurred. Also, since the rods are used in double-end cylinder compressors this permitted leakage of the product and contamination of the air.

The company originally tried metallizing on shafts returned by users for reconditioning and found that they not only lasted several times longer from the usual standpoint of diameter loss, but that galling no longer occurred.

As a result of their experience with the repair of piston rods by metallizing, all new piston rods to be used for corrosive gases are now made of carbon steel and metallized with stainless.

Photograph Courtesy of Metallizing Engineering Co., Inc.

Circle No. 181 on Reader Service Card.

BRAND NEW

VERTICAL-HORIZONTAL BASE

DE-STA-CO

TOGGLE CLAMP

SPECIALLY DESIGNED FOR WELDING APPLICATIONS

with low silhouette

the fixture-hugger that makes it far easier to insert and remove work . . .

and complete clearance

of working area due to flop-over holding bar—ideal for positioning metal or plastic sheets!

Send For FREE CATALOG on the new DE-STA-CO Models 507 and 509

DE-STA-CO DETROIT STAMPING COMPANY

World's FIRST Line of TOGGLE CLAMPS

324 Midland Avenue • Detroit 3, Michigan

Circle No. 70 on Reader Service Card.

Resistance welding magnesium alloys requires proper cleaning, electrodes and adjustment of machine. Read this article and use these pointers to get good welds.

MAGNESIUM . .

Easily Joined by Resistance Welding

CONSISTENTLY good spot welds in magnesium alloys can be successfully made if you follow these conditions of preweld cleaning, equipment requirements and choice and maintenance of electrodes.

Purpose of surface cleaning is to obtain a low, uniform contact resistance. Magnesium alloys have either a chrome-pickle or an oiled coating, which must be removed for satisfactory spot welding. Oil can be removed by immersion in a vapor degreasing tank or emulsion type cleaner, or it can be removed locally by washing with solvents.

Protective chrome-pickle coating can be removed by a preliminary dip in chrome-pickle solution for 15 to 30 seconds followed by a 10 minute immersion in hot, strong caustic solution. This is followed by steel wool cleaning or wire brushing of metal surfaces which contact the electrodes and thus increases tip life.

Note: Specification for resistance welding magnesium alloys is Mil-W-6860.

Choice of Equipment

D.C. and A.C. resistance welders similar to those used on aluminum

BERNARD
WELDING PRODUCTS
ELECTRODE HOLDERS

Request 16-page Booklet
FORM SS-3

"Shortstub"

The jaws substitute for stub waste by splicing a 2 inch extension to the length of every electrode.

"Multi-Pic"

WELD CLEANING
HAMMERS

Request Bulletin
FORM MP-6

Delivers FIVE surface cleaning blows with each swing and lasts FIVE times longer than single headed hammers.

Request Bulletin
FORM PCB-6

"Pro-Clamp"
MECHANICAL HANDS

MODERNIZE the fabrication of plates, shapes, rods, bars, pipes, etc. MAKE fitting, positioning, holding, and welding a fast, accurate, inexpensive, one-man job.

Mfg. by
BERNARD WELDING EQUIPMENT CO.

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Circle No. 72 on Reader Service Card.

Recommended Weld Spacing and Edge Distances in Inches for Magnesium Resistance Welding

Sheet Thickness	*Spot Spacing*		*Edge Distances*	
	Minimum	*Minimum*	*Nominal*	*Nominal*
0.020	0.25	0.50	0.15	0.25
0.025	0.25	0.50	0.16	0.25
0.032	0.31	0.62	0.18	0.25
0.040	0.38	0.75	0.20	0.25
0.050	0.41	0.75	0.23	0.31
0.063	0.50	1.00	0.27	0.38
0.080	0.62	1.25	0.31	0.41
0.102	0.62	1.25	0.37	0.50
0.120	0.75	1.50	0.44	0.62

have sufficient capacity and provide adequate control of current and pressure when fabricating magnesium. Rapid electrode follow-through is required to maintain pressure on the weld while the material is in the plastic range. Since magnesium can be welded with lower pressures than required for aluminum, narrower flanges, closer edge spacing and smaller offset electrodes for welding within a confined space are acceptable.

Correct Electrodes

Hard, high conductivity copper alloys (R.W.M.A. Class 1) should be used as electrode material. Electrodes and holders should be water cooled. Electrode faces should be cleaned regularly to prevent tip pick-up and burning. Use 2/0 to 4/0 emery paper to maintain a clean electrode surface; metal, plastic, and rubber strips can be

(Please Turn Page)

Machine Setting for Resistance Welding Annealed Magnesium Alloy with A.C. Machine

Thickness, In.	B&S Gage	Time, Cycles	Pressure, Lb.	Current, Amp.	Tip		Shear Strength, Lb./Spot
					Top	Bottom	
0.016	26	3	500	21,000	7° cone	Flat	60
0.020	24	3	550	22,000	7° cone	Flat	90
0.025	22	4	600	23,000	7° cone	Flat	120
0.032	20	4	700	24,000	7° cone	Flat	170
0.040	18	6	750	26,000	7° cone	7° cone	250
0.051	16	8	850	28,000	7° cone	7° cone	330
0.064	14	10	950	30,000	7° cone	7° cone	480
0.081	12	12	1000	33,000	7° cone	7° cone	710
0.102	10	12	1100	38,000	7° cone	7° cone	1000
0.128	8	15	1200	43,000	7° cone	7° cone	1350

Note: Electrode diameter of 5/8 in. is satisfactory for all sheet gages up to and including 0.081 in. Above this gage an electrode diameter of 7/8 in. is recommended.

It's Tops

FOR SOLVING FLAME CUTTING PROBLEMS

Small or large—OHMSTEDE's time and labor saving equipment provides faster, easier cutting at lower costs.

Here are 8 big reasons why OHMSTEDE is your best buy.

- Unlimited variety of shapes
- Wide cutting range—cuts 42" dia circle and straight line of 89"
- Spindle and automatic magnetic tracing
- Operates on either alternating or direct current
- Delivered with base—no extras required
- Sealed ball bearing construction
- Enclosed motor
- Low initial cost—high efficiency

OHMSTEDE flame cutting machines are the end-result of many years of development. Ruggedly constructed, they give trouble-free service and unexcelled performance under all conditions of use.

Write for complete details.

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MACHINE WORKS
897-899 N. MAIN ST. • BEAUMONT, TEXAS

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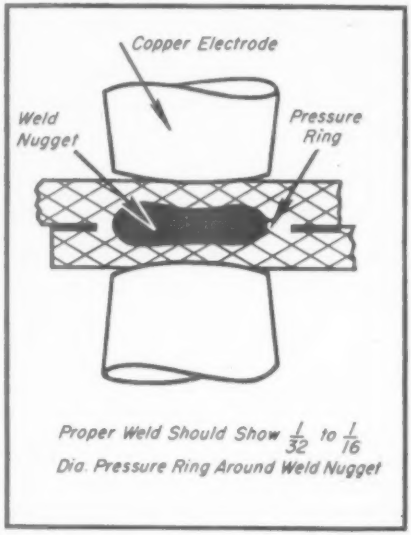
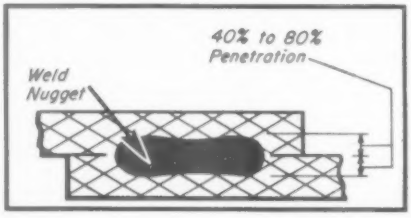
used as backing material so as to maintain correct tip contour.

Trial welds should be made on material of the same gage, alloy, hardness, and surface preparation



Cross Sections of correctly made welds.



as the material to be welded. Five or six sample welds are usually made at a predetermined machine control setting. Three tension-shear pulls will assure the proper strength. The other spotwelds should be cross sectioned, polished and etched with 10% acetic acid for three to ten seconds. A good standard for penetration limits is not less than 40% nor more than 80%.

If cracks, excessive porosity,

small weld diameter or low strength high penetration exists, it may be necessary to increase the pressure. Low penetration can be corrected by increasing the current output. For expulsion or sheet separation the whole set up should be examined. If the weld nugget is displaced mostly into one sheet, either a smaller face radius electrode should be used against the sheet with low penetration or an increased face radius electrode used against the sheet with high penetration.

For suitable protection of spot welded assembly, immerse in either a chrome-pickle or a 10% sodium dichromate solution. The latter is used where greater corrosion resistance is required.

DISSIMILAR METALS

(Continued from Page 67)

pure copper of high conductivity through the copper-tungsten alloy series to pure tungsten which has a still higher resistance. Pure tungsten is seldom used except in cases where two pieces of metal of very high heat conductivity are to be welded.

If the conductivities of the component parts are not widely different, a satisfactory heat balance may usually be obtained by using the same type of electrodes on both sides of the joint.

Butt-Welding

Theoretically any combination that can be spot welded can also be butt welded; and as with butt welds in most materials, flash welding is the most satisfactory method. It is generally necessary to compensate for differing electrical and thermal conductivities of the two pieces by projecting the one with the higher conductivity further from the dies to strike a heat balance.

Information Courtesy Resistance Welder Manufacturers' Association.

SAVE COPPER..
keep tips well dressed with
PORTER ELECTRODE TIP DRESSERS

EXTENDED TYPE

FLUSH TYPE STRAIGHT

FLUSH TYPE TAPERED

Dress Worn Tips Without Removing Them From Welder. Floating Cutter Blade keeps all Porter Dressers centered on electrode . . . Low overall height, ¾" . . . Adaptable for use on power tools, portable drills and lathes.

Write for information on sizes and prices.

C. O. PORTER Machinery Co.
676 Front Ave., Grand Rapids, Mich.

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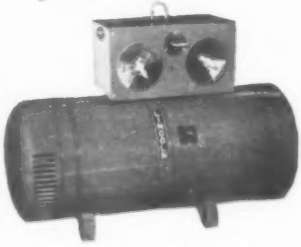
WELDERS ALWAYS ASK:

"But is it as good as a Lincoln 'Shield-Arc'?"

Here's why the Lincoln "Shield-Arc" welder is *the standard of comparison* for arc welders:

1. "Shield-Arc" delivers *any* type of direct current arc . . . not one or two types.
2. "Shield-Arc" delivers constant output of current, regardless of line voltage fluctuations.
3. "Shield-Arc" welders are constantly improved to weld faster . . . at lower and lower costs.



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DC MOTOR-GENERATOR WELDER
200-300-400-600-900 amps.

GET LATEST FACTS on cutting your welding costs. Send for Bulletin 459, available by writing on your letterhead to:

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DEPT. 1809 • CLEVELAND 17, OHIO
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

Circle No. 75 on Reader Service Card.

Chicago's International Amphitheater will house exhibits that feature latest in welding, brazing and cutting equipment, supplies and accessories.

A.W.S. Holds 35th Annual Meeting in Chicago, November 1st Thru 5th

NINETEEN sessions covering all phases of welding activities will feature the 35th American Welding Society National Fall Meeting to be held in Chicago, November 1 to 5. Fifteen hundred welding and production engineers, technical management men and others interested in welding are expected to attend these sessions where 57 papers will be presented.

Among the subjects to be discussed are the welding of titanium, zirconium and molybdenum, the use of welding in the production of aircraft and rockets, welding high temperature materials, inert-gas-shielded arc welding, resistance welding and fused metallized coatings. All sessions will be held at the Sherman Hotel.

Highlight of the meeting will be the Adams Lecture to be presented by William L. Warner of Watertown Arsenal. His paper will be on "The Toughness of Weldability." At this same session a number of other honors will be presented to individuals for outstanding contributions of the advancement of welding.

The AWS Annual Fall Meeting will run concurrently with the National Metals Exposition at which welding and cutting exhibits and demonstrations will be shown. The Exposition will be held at the International Amphitheater.

TENTATIVE PROGRAM

AWS Fall Meeting

November 1—5, 1954 Sherman Hotel — Chicago, Ill.

WELDING AND CUTTING EXHIBITS AND DEMONSTRATIONS
NATIONAL METALS EXPOSITION
International Amphitheater, Chicago, Illinois

HOURS OF THE EXPOSITION	**Monday, Tuesday and Wednesday** **November 1, 2 and 3, 12 Noon to 10:30 P. M.** **Thursday and Friday** **November 4, 5, 10:00 A. M. to 6:00 P. M.**

Admission by special invitation or by AWS registration badge or membership card of any participating society.

MONDAY MORNING NOVEMBER 1st

Chairman — F. L. PLUMMER, *President*, American Welding Society

Co-Chairman—H. C. BOARDMAN, *Chairman*, Technical Papers Committee

Louis XVI Room

10:00 A. M.—PRIZE AWARDS

10:30 A. M.—ADAMS LECTURE
The Toughness of Weldability
by WILLIAM L. WARNER, Watertown Arsenal

MONDAY AFTERNOON NOVEMBER 1st—2:00 P. M.
Two Simultaneous Sessions

1—RESISTANCE WELDING
Ballroom

Flashwelding High-Strength Steels
by W. G. Fassnacht, Bendix Aviation Corp.

Effect of Post Treatment on the Properties of Flash Welds
by Ernest F. Nippes, Warren F. Savage, Gordon Grotke and S. M. Robelotto, Rensselaer Polytechnic Institute

The Effects of Prestressing on the Strength Characteristics of Spot Welds in 17-7 Stainless Steels Under Cyclic Loads
by V. N. Krivobok, International Nickel Co., and J. A. Choquet and G. Welter, Ecole Polytechnique

2—WELDABILITY
Assembly Room

The Effect of Microstructure on Notch Toughness—Part II
by John H. Gross and Robert D. Stout, Lehigh University

Impact Testing Weld Metal and Heat-Affected Zone Simultaneously
by W. P. Hatch, Jr., and C. E. Hartbower, Watertown Arsenal

Applicability of Charpy Test Data
by Peter P. Puzak, Martin E. Schuster and W. S. Pellini, Naval Research Laboratory

MONDAY EVENING
NOVEMBER 1st

6:00 P. M.
President's Reception
Crystal and Louis XVI Rooms

8:00 P. M.
National Dinner
Bal Tabarin

TUESDAY MORNING, NOVEMBER 2nd—9:30 A. M.
Three Simultaneous Sessions

3—WELDABILITY
Assembly Room

Isothermal Studies on Weld-Metal Micro-cracking in Mild Steel
by Alan E. Flanigan and Z. P. Saperstein, University of California

Crack-Starter Tests of Ship Fracture and Project Steels
by P. P. Puzak, Martin E. Schuster and W. S. Pellini, Naval Research Laboratory

Continuous Cooling Transformation Characteristics of Three Types of Weld Metal
by E. F. Nippes and E. C. Nelson, Rensselaer Polytechnic Institute

4—RESISTANCE WELDING
Crystal Room

Spot Welding Aluminum with Single-Phase Equipment
by J. W. Kehoe and D. R. McCutcheon, Westinghouse Electric Corp.

Seam Welding Low-Carbon Steel
by M. L. Begeman and Gene C. Walker, University of Texas

Automatic Percussion Welding
by A. L. Quinlan, Western Electric Co.

5—SHIELDED ARC WELDING
Louis XVI Room

Recent Developments in Contact Electrodes
by D. L. Mathias, Arcrods Corp.

Electrodes with Powdered Metal Coatings, A Progress Report
by Jerry Hinkel, The Lincoln Electric Company

Metallic Rectifiers for Arc Welders
by G. K. Willecke, Miller Electric Mfg. Co.

TUESDAY AFTERNOON, NOVEMBER 2nd—2:00 P. M.
Section Officers Meeting
Crystal Room

Technical Meetings Cover All Phases

TUESDAY AFTERNOON, NOVEMBER 2nd—2:00 P. M.
Two Simultaneous Sessions

6—WELDABILITY
Assembly Room

Arc Welding Embrittlement of Powder Metals
by Albert Sill, Jr., and C. C. Mathias, Sperry Corp.

Weldability of Wrought, High-Alloy Materials
by R. P. Culbertson, Haynes Stellite Co.

7—SURFACING
Louis XVI Room

High Nickel Alloy Overlays on Ferrous Metals
by George R. Pease, H. B. Bott and H. C. Waugh, International Nickel Co.

The Inert Gas Metal Arc Overlay Process
by C. R. Felmley, Air Reduction Sales Co., Inc.

Automatic Hard Surfacing in the Mining and Construction Industries
by I. R. Bartter, Automatic Welding Co.

WEDNESDAY MORNING, NOVEMBER 3rd—9:30 A. M.
Three Simultaneous Sessions

8—AIRCRAFT AND ROCKETRY
Crystal Room

Production of High-Strength Aluminum Alloy Rocket Motor Tubing by Means of an Induction Weld Tube Mill
by W. S. Tenner and H. C. Wheeler, U. S. Naval Ordnance Test Station

Metallurgical Aspect of Welding Precipitation Hardening Stainless Steels
by C. W. Funk and M. J. Granger, Aerojet-General Corp.

The Macro Etch System of Evaluating Quality of Resistance Welding
by D. O. Samuelson and F. G. Harkins, Solar Aircraft Co.

9—TITANIUM, ZIRCONIUM AND MOLYBDENUM
Louis XVI Room

Notch Toughness of Weld Deposits in Titanium Plate
by D. M. Daley, Jr., and C. E. Hartbower, Watertown Arsenal

The Welding of Zirconium
by Ralph V. Hilkert and Harold H. Hollenbeck, Titanium Alloy Manufacturing Division, National Lead Co.

The Influence of Oxygen on the Joining of Molybdenum
by Timothy G. Perry, H. Stephen Spacil and John Wulff, Massachusetts Institute of Technology

10—INERT ARC WELDING
Assembly Room

New Techniques in Inert-Gas-Shielded Metal-Arc Welding
by R. W. Tuthill, General Electric Co.

Inert Gas Welding of Stator Packs
by F. J. Pilia, Linde Air Products Co.

A Production Application of Inert-Gas-Shielded Arc Welding of Mild Steel
by John L. Lang, Lukenweld Division of Lukens Steel Co.

WEDNESDAY AFTERNOON, NOVEMBER 3rd—2:00 P. M.
Three Simultaneous Sessions

11—PRESSURE VESSELS AND PIPING
Assembly Room

The Plastic Fatigue Behavior of High-Strength Pressure Vessel Steels
by John H. Gross and Robert D. Stout, Lehigh University

Further Studies of the Biaxial Fatigue Properties of Pressure Vessel Steels
by C. E. Bowman and T. J. Dolan, Department of Theoretical and Applied Mechanics, University of Illinois

Automatic Tungsten-Inert-Arc Welding of Pipes in Position, Without the Use of Backing Rings
by L. C. McNutt, Benjamin F. Shaw Co.

12—BRAZING
Crystal Room

Silver Brazing of Refractory Metals
by C. H. Chatfield, Handy & Harman

Filler-Metal Strengths in Brazed Copper Joints
by W. H. Munse and D. C. Crawford, University of Illinois

Investigation of the Factors Determining the Tensile Strength of the Brazed Joint
by Nikolajs Bredzs, Armour Research Foundation of Illinois Institute of Technology

13—SYMPOSIUM ON FUSED METALLIZED COATINGS
(Sponsored by AWS Committee on Metallizing)
Louis XVI Room

Fundamentals of Fused Metallized Coatings
by Bela Ronay, U. S. Naval Engineering Experimental Station

Practical Applications of Fused Self-fluxing Metallized Coatings
by Harvey S. Miller, New England Hardsurfacing Co.

Practical Applications of Fused Non-self-fluxing Metallized Coatings
by Sam Tour, Sam Tour & Co., Inc.

WEDNESDAY EVENING, NOVEMBER 3rd
6:30 P. M.—WRC University Dinner
Emerald Room

8:00 P. M.—WRC University Conference
Crystal Room

THURSDAY MORNING, NOVEMBER 4th—10:00 A. M.
Board of Directors Meeting
Jade Room

THURSDAY MORNING, NOVEMBER 4th—9:30 A. M.

Three Simultaneous Sessions

14—AIRCRAFT
Crystal Room

Considerations for Fatigue in Aircraft Welding Design
by J. Koziarski, Piasecki Helicopter Corp.

Properties of Welds in Al-Mg-Mo Alloys XK186 and XK183
by L. A. Cook and S. L. Channon, Kaiser Aluminum and Chemical Corp., and A. R. Hard, State College of Washington

High-Temperature Alloy Brazing of Thin Materials for Jet Engines
by A. S. Rose and W. N. Lewis, I-T-E Circuit Breaker Co.

15—DESIGN AND PRODUCTION
Assembly Room

Prediction of Angular Distortion Caused by One-Pass Fillet Welding
by T. Kumose, T. Yoshida, T. Abbe and H. Onoue, Yokahama Shipyard & Engine Works, Mitsubishi Nippon Heavy-Industries, Ltd.

Triaxial Tensile Stresses in Arc Welded Mild Steel
by Harry E. Kennedy, University of California

Automatic Welding Builds Railroad Cars
by H. D. Hollis, Texas & Pacific Railway Company

16—CUTTING
Ballroom

Oxygen Cutting with Iron Powder and Chemical Flux Additives
by R. L. Deily and J. R. Kirwin, Air Reduction Sales Co.

Sigma Arc Cutting
by R. S. Babcock, Linde Air Products Co.

Improved Method of Oxy-Fuel Gas Combustion.
by Edward H. Roper, Air Reduction Sales Co.

THURSDAY AFTERNOON, NOVEMBER 4th—2:00 P. M.

Business Meeting
Crystal Room

ARRANGE TWO PLANT VISITS

Arrangements have been made for two plant visits during the AWS National Fall Meeting which is to be held in Chicago, November 1-5. The visits are scheduled on successive days so as to allow participation in both.

On Wednesday morning, November 3rd, at 9 a. m., a tour will be made of the Hotpoint Company's new refrigerator manufacturing plant in Cicero, Illinois. During the tour guests will see actual welding and brazing operations and inspect latest in automatic resistance welders and inert gas and oxy-acetylene equipment.

On Thursday morning, November 4th, at 9 a. m., a tour will be made of the Whiting Refinery and Research Laboratories of Standard Oil Company of Indiana. After touring the most interesting portions of the refinery, including the Welding Shop, group will be taken through those portions of the Research Laboratory and Engineering Building which will be of interest to AWS visitors.

Welding of Problem Metals

FRIDAY MORNING, NOVEMBER 5th—9:30 A. M.

Three Simultaneous Sessions

17—HIGH-TEMPERATURE MATERIALS
Assembly Room

An Investigation of the Hot Ductility of High-Temperature Alloys
by Ernest F. Nippes, Warren F. Savage, H. F. Mason and B. J. Bastian, Rensselaer Polytechnic Institute

Interpreting Graphitization in High-Temperature, High-Pressure Steam Piping
by H. Thielsch, E. M. Phillips and E. R. Jerome, Jr., Grinnel Co., Inc.

The Welding of Type 347 Stainless Steel for the Higher Steam Turbine Operating Temperatures
by R. M. Curran and A. W. Rankin, General Electric Co.

18—STRUCTURAL
Ballroom

Behavior of Welded Single Span Frames Under Combined Loading
by C. G. Schilling, F. W. Schultz, Jr., and L. S. Beedle, Lehigh University

Fatigue Strength of Butt Welds in Structural Steels
by L. A. Harris, G. E. Nordmark and N. H. Newmark, Talbot Laboratory, University of Illinois

New Concepts in Spot X-Ray of Welded Structures
By Harold Hovland, Industrial X-Ray Engineers

19—APPLICATIONS
Old Chicago Room

How to Apply Semi-automatic Submerged Arc Welding
by Robert A. Wilson, Lincoln Electric Company

Mechanized Flame Descaling, Dehydrating and Priming of Prefabricated Plate
by C. H. Cowan, Avondale Marine Ways, Inc., and J. R. Kirwin, Air Reduction Sales Co.

Automatic Hardsurfacing with Mild Steel Electrodes and Agglomerated Alloy Fluxes
by J. S. McKeighan, The Lincoln Electric Company

LADIES' REGISTRATION

Sunday Evening, October 31 through Thursday, November 4

SUNDAY, OCTOBER 31st

Coffee Reception, 6:00-8:00 P. M., Orchid Room, Sherman Hotel

This reception will provide an opportunity for meeting Chicago Section Officers and their wives

MONDAY, NOVEMBER 1st

Coffee Hour, 10:00 A. M.—Orchid Room

Luncheon, 12:00 noon—Kungsholm, 100 E. Ontario St.

Puppet Opera, Kungsholm Theater following luncheon

TUESDAY, NOVEMBER 2nd

Coffee Hour, 10:00 A. M.—Orchid Room

Luncheon, 12:30 P. M.—Exclusive M & M Club, Merchandise Mart Building

Escorted tour of Merchandise Mart will follow luncheon

WEDNESDAY, November 3rd

Coffee Hour, 10:00 A. M.—Orchid Room

Luncheon, 12:30 P. M. Wedgewood Room, Marshall Field State St. Store

Fashion Show to be held during luncheon

THURSDAY, NOVEMBER 4th

Escorted tour of Marshal Field's Store following luncheon

Buffet Luncheon, 11:30 A. M.—Orchid Room

Theater Party 1:30 P. M.—Palace Theater — Cinerama (or sequel)

Theater party for both men and women as long as reservations are available

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Here's Complete List of Welding Exhibitors at 1954 Metal Exposition—November 1-5

A

Acetogen Gas Co. 2147
Acme Mfg. Co. 1640
Air Reduction Sales Co. 341
Ajax Electric Co., Inc. 752
Alpha Metals, Inc. 2344
American Manganese Steel Division 762
American Brake Shoe Co. 762
American Optical Co. 2229
American Wheelabrator & Equipment Corp. 632
Arcair Company 1445
Aronson Machine Co. 2354

B

Balteau Electric Corp. 2246
Banner Mfg. Co. 1019
Branson Instruments, Inc. 2244
Bridgeport Brass Co. 1015
Brush Electronics Co. 2317

C

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Challenge Machinery Co. 2130
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WHAT TO SEE AT THE SHOW

Exhibitors listed here will feature equipment, accessories and related products for use in arc welding, inert arc welding, oxy-acetylene welding, cutting and brazing and resistance welding.

If you were unable to attend the show and would like additional information about new developments on products exhibited, write the Editor, INDUSTRY & WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio, mentioning the specific company in which you are interested.

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"Don't scrap it . . . braze-weld it" paid off handsomely when this inner ram was twice repaired.

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ALUMINUM - - - Why, Where and How to Use It.

DURING a fairly short time, many changes in the methods of welding and brazing aluminum have taken place. Development of these methods has hinged on the introduction of new aluminum alloys and refinement of those already in existence.

Therefore, a closer inspection of the metallurgical aspects of this metal can often produce dividends in increased welding efficiency.

Listed here are the functions of alloying elements in aluminum. In tabular form are aluminum alloys, their physical properties, typical uses and recommended filler metal for brazing or oxy-acetylene welding.

(Material prepared by Thomas D. Nast, president, All-State Welding Alloys Co., Inc.)

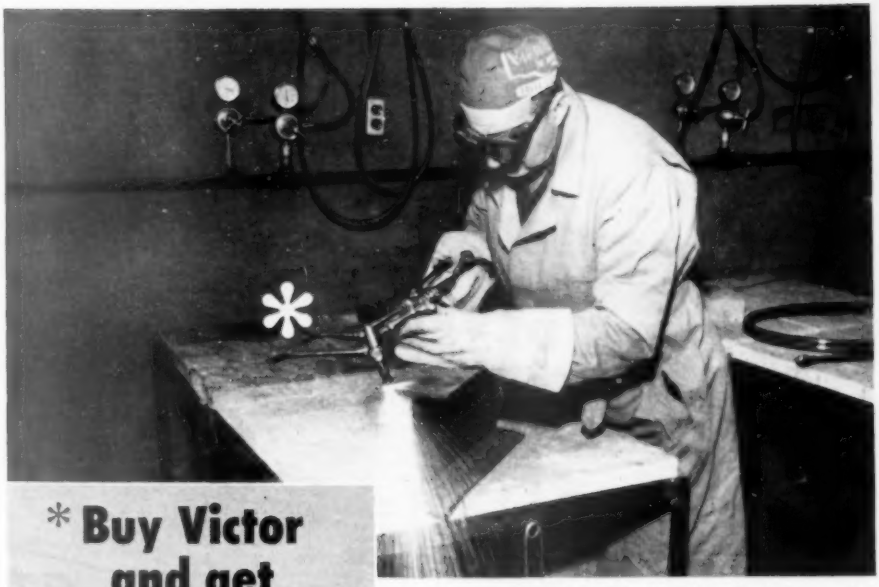
FUNCTIONS OF ALLOYING ELEMENTS IN ALUMINUM

ELEMENT	PROPERTIES ADDED TO ALUMINUM	Alloys in Which This Element is a Principal Alloying Element
Silicon	Adds flow properties, prevents hot short, lowers temperature, increases corrosion resistance, lowers specific gravity, lowers thermal expansion maintains high heat and electrical conductivity.	356 718 32-S 716 43-S 13
Magnesium	Adds strength, decreases weight, increases corrosion resistance to salt water, improves machinability, non-tarnishing.	53-S 56-S 54-S 214
Copper	Adds strength, good casting characteristics, reduces corrosion resistance, increases density, lowers thermal expansion, lowers conductivity, permits age hardening.	195 108 122
Nickel	Adds strength and hardness at elevated temperatures.	18-S 142
Chromium	Adds resistance to stress corrosion.	51-S
Manganese	Adds strength while maintaining corrosion resistance and electrical conductivity.	3-S
Lead & Bismuth	Adds machineability.	11-S
Tin	Adds frictional wear resistance.	750
Magnesium & Silicon and Copper & Manganese	Permit heat treatment and age hardening.	61-S 14-S 63-S 17-S 355 24-S 25-S
Zinc	Adds corrosion resistance.	75-S 72-S 40-E

Other elements added for strength at high temperatures are Titanium, Vanadium
Iron, found as impurity, has no great effect on aluminum.

ALUMINUM — Why, Where and How to Use It . . .

Alloy	AVERAGE Tensile Strength PSI	AVERAGE Elongation %	At Temper	RECOMMENDED JOINING MATERIAL Gas Welding	RECOMMENDED JOINING MATERIAL Brazing	Typical Use	Alloy
2-S	13000	45	0	2-S	718	Food and chemical handling equipment, architectural components.	2-S
3-S	16000	40	0	2-S	718	Cooking utensils, storage tanks, TV ground wire.	3-S
11-S	53000	15	T-3	not recommended	.....	Screw machine parts. Forgings requiring machining.	11-S
14-S	56000	25	T-4	not recommended	.....	Heavy duty forgings, aircraft fittings.	14-S
17-S	62000	22	T-4	not recommended	.....	Rivets, hardware, structural parts.	17-S
18-S	63000	17	T-61	not recommended	.....	Cylinder beads, pistons.	18-S
24-S	68000	22	T-4	not recommended	.....	Aircraft structures, rivets.	24-S
25-S	57000	18	T-6	not recommended	.....	Airplane propellers, engine crankcases.	25-S
32-S	56000	8	T-6	not recommended	.....	Forged pistons.	32-S
51-S	47000	20	T-6	43-S	718	Crankcases, fuse parts, automotive parts.	51-S 51-S
52-S	29000	30	0	52-S 43-S	718	Fuel and oil lines, fuel tanks, marine parts.	52-S
53-S	39000	20	T-6	52-S 43-S	718	Petroleum refining, beer barrels, naval construction.	53-S
54-S	35000	30	0	54-S 52-S 43-S	718	Aircraft and naval construction.	54-S
56-S	42000	35	0	56-S	718	Rivets, aricraft and marine construction.	56-S
61-S	35000	22	T-4	61-S 43-S	718	Pontoon boats, furniture, window frames.	61-S
63-S	35000	12	T-6	61-S 63-S 43-S	718	Furniture, ornamental pieces.	63-S
75-S	88000	10	T-6	not recommended	.....	Aircraft structural parts.	75-S
13	37000	1.8	die cast	718	.....	Thin walled and intricate castings.	13
43	24000	9	mold cast	43-S	718 - 716	Die castings, cooking utensils, food handling equipment.	43 43
108	21000	2.5	sand cast	43-S	not brazed	Manifolds, valve bodies.	108
122	27000	1.0	sand cast T-2	43-S	not brazed	Cylinder head, pistons, bushings.	122
142	47000	0.5	mold cast T-61	142 43-S	not brazed	Motorcycle and aircraft pistons, generator housings.	142
195	36000	5.0	sand cast T-6	43-S 195	not brazed	Wheels, flywheel housings.	195
214	25000	9.0	sand cast	43-S 195	not brazed	Dairy equipment.	214
355	43000	4.0	mold cast T-6	355 43-S	not brazed	Fuel pumps, air compressors, water jackets.	355
356	33000	4.0	sand cast T-6	356 43-S	not brazed	Pump parts, transmission cases, cylinder blocks.	356
750	22000	12.0	mold cast T-5	not recommended	.....	Bearings, and bushings.	750
40-E	35000	5	sand cast	40-E	not brazed	Airplane stressed parts, instrument parts, parts subject to shock.	40-E



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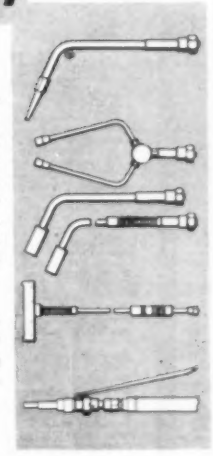

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14

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(Pat. Pending)

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(Pat. Pending)

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by John S. Kirby, President
Alloy Ring Service, Inc.

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BY ACTUAL COMPARISON

USING NON-AUTOMATIC TORCH . . . . . 12 Pieces Welded
USING NON-AUTOMATIC WITH GAS SAVER . . 18 Pieces Welded
USING HARRIS AUTOMATIC TORCH . . . . 28 Pieces Welded

Using the same amount of Oxygen and Acetylene for each set-up, this "Actual Comparison" Demonstration proved the Harris Automatic Torch to be a profitable investment for economical and efficient welding work.

Let our local Distributor show you the "Actual Comparison" test in your plant and explain quickly and simply why the Harris Automatic has the greater piece production at the lowest cost.

ALMOST 50 YEARS OF "KNOW-HOW"

Harris is the originator of the "Automatic" Torch and with almost 50 years of building "Know-How" behind every torch, the buyers and users get tremendous returns on their torch investment.

Harris' long established Distributors, located in all principal cities in the United States and Foreign Countries, are at your service.

HOME OF AMERICA'S FIRST AND FINEST GAS WELDING AND CUTTING APPARATUS.

THE HARRIS CALORIFIC COMPANY
Cleveland 2, Ohio

HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

Circle No. 81 on Reader Service Card.

brazing, especially in the electrical industry, is accomplished at medium temperatures with a self-fluxing alloy.

Brazing inserts of commercially pure copper are effectively used in the reducing-atmosphere electric furnace for brazing steel to steel.

In all brazing operations it is important that components of the assembly present chemically clean surfaces through joint areas. Grease and dirt must be removed by the usual chemical solutions. Oxides and mill scale must be removed either by shot-blasting or by pickling.

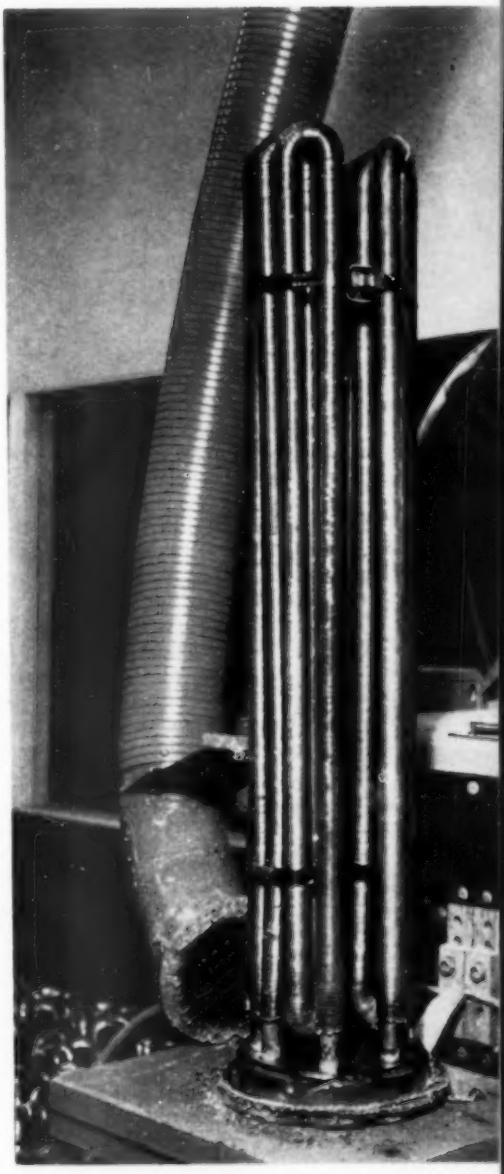
Close Temperature Control

It is important to maintain temperature of the brazing furnace as close as possible to the liquidus temperature of the brazing insert. Close control of temperature during copper brazing prevents heat distortion of the work. The silver brazing alloys (and the lead-tin alloys as well) require reasonably accurate control of furnace temperature in order to prevent voids in the brazed joint caused by gas bubbles in the flux or by the subliming of the more volatile components of the brazing alloy.

Maximum shear strength is obtained in copper brazing when a light press fit is employed. In assembling the fitting with the compressor dome (shown in the illustration) the maximum fit-up clearance should not be in excess of 0.003 inches. Greater clearance reduces maximum shear strength of the joint and causes pressure leaks.

Use Induction Heating

Induction heating solved a particularly difficult brazing problem presented by a heat exchanger. The operation had to be performed in the vertical position to maintain alignment of the copper tubes



Induction heating was used to braze this heat exchanger because it was not desirable to heat the entire assembly. Excessive heat could cause distortion.

and the steel header. Two metal supporting bands applied to maintain proper alignment during the induction brazing cycle were not removed until final assembly. Only the open ends of the copper tubes (inserted in the header flange) were heated with the flange by induction heating, thus preventing the serious heat distortion developed if the entire assembly was heated to brazing temperature. A low melting range silver alloy is used to secure six pressure-tight joints, simultaneously.

This same brazing operation also illustrates the adaptability of continuous furnace brazing to four different assemblies requiring the same brazing temperature.

Brazing inserts are packaged on a tube to prevent damage in handling and time wasted in untangling these flexible rings.

Brazing Insert Design

Even though the brazing operation, as a general rule, offers the most economical method for joining a multiplicity of components into a strong, pressure-tight assembly unit, the process engineer is also concerned with effecting the greatest possible production economy from the operation. The cost factors involved, per unit of production, are, broadly, four:

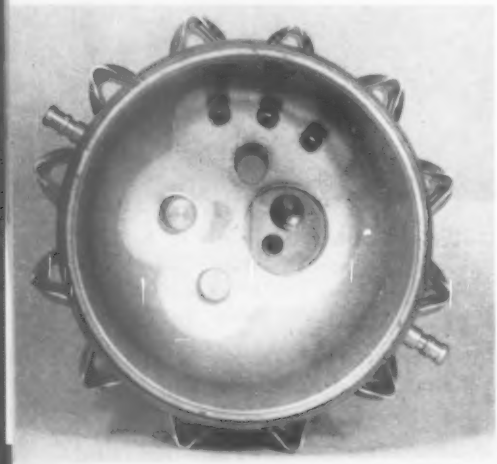
1. Capital charge against furnace and floor space.
2. Payroll, including direct labor, inspection, supervision, etc.
3. Cost of brazing inserts used per unit of production.

All three of the above general cost factors are vitally affected by the design of the brazing insert. An excessive volume in the brazing insert causes overfills that may require additional expense to remove in a subsequent machining operation; while an insufficient volume may cause rejections requiring expensive salvage operations.

Circular Insert is Cheapest

The cheapest in first cost is the circular brazing insert, preformed from wire of uniform cross section. However, specific operations may require an insert stamped and formed from sheet stock to conform to an irregular contour of the product design. In such instances where it is not desirable to change product design, the stamped, or otherwise irregularly formed, insert becomes the most economical to use.

Designed for specific brazing operations, inserts can be preformed from copper, silver, lead-tin, or aluminum brazing alloys to meet specific production requirements.



Lighter colored area on pressed steel compressor dome is caused by thin film of copper from preformed brazing inserts used in brazing operation. This copper film is reliable visual evidence that all brazed joints are pressure-tight.

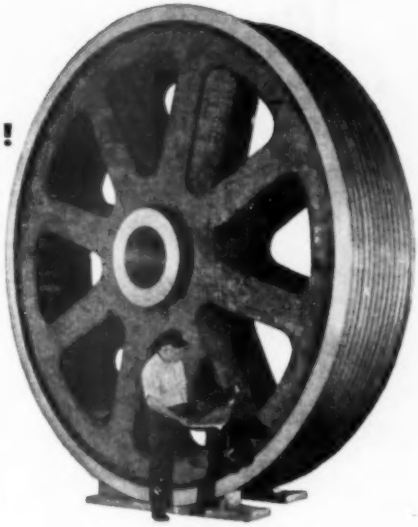
IF YOUR PRODUCT IS WELDED A.W.S. CAN HELP YOU!

Many of the advancements in welding design these days spring directly from the membership of the American Welding Society.

Most of the engineers in welding industries depend on A.W.S. to keep in touch with technological advancements outside the boundaries of their own plant and their own day-by-day welding experience.

Many of their achievements in saving weight, improving products and reducing manufacturing costs can be traced directly to discussions and exchange of ideas at their frequent A.W.S. section meetings.

If you use welding in your business, make sure that your welding people are taking full advantage of the opportunities A.W.S. offers.



This giant welded sheave is 15 feet in diameter, the hub is a center bored forging, and the entire weldment weighs 34 tons. — Photo courtesy Bethlehem Steel Co.

A. W. S. Builds "MEN OF WELDING"

There are 66 active local sections of A.W.S. covering the entire United States. The 9,683 members of A.W.S. hold monthly technical meetings and plant visitations where they observe practical solutions to typical welding problems and study new welding methods. They receive accurate information on welding design, fabrication and maintenance through discussions with the best welding minds in the nation and authoritative printed reports.

"Men of Welding" advance in their profession through technical meetings and group discussions on welding methods and practices.

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a precision
instrument!

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures—plus or minus 1%.

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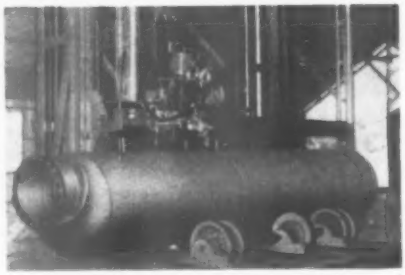
Conclusion

As a manufacturing process for assembling a multiplicity of separate components into a single high-strength and pressure-tight assembly, brazing has long since passed through the pioneer stage of trial and error. It is no longer a hit-or-miss art, dependent upon the individual skill and ingenuity of the furnace operator. It is a mature manufacturing process, under complete control by the process engineer.

To the designing engineer, brazing opens up new fields of design in which high strength, minimum total weight, and pressure tightness are mandatory.

Circle No. 15 on Reader Service Card.

Special Welding Machine for Pressure Vessels



A welding machine capable of handling pressure vessels up to 120 feet long by 16 feet in diameter and weighing 100,000 lbs. has been designed and put in operation by Master Tank and Welding, Dallas, Texas. All motor-powered, the unit works by remote control from a front panel, located next to the operator. The tank is rotated for welding around the circumference. The actual welding machine travels under its own power on a track that is 120 feet long. Electrical power control can move and adjust the welder in a matter of seconds.

Circle No. 182 on Reader Service Card.

Can A Technical Library Help Solve Your Problems?

If you are planning to organize your own technical library, you will get expert advice from a paper "How to Start a Small Metallurgical Library" to be given at the Thursday, November 4th, Session of the Metal Division, Special Libraries Association's fall meeting at the Conrad Hilton Hotel.

Mrs. Margaret H. Fuller, Chairman, Metals Division, Special Libraries Association.

In conjunction with the American Society for Metals, the group will maintain a typical technical library at Booth 802 in the International Amphitheater. A staff of trained literature specialists will offer on-the-spot reference service.

Reference material, special bibliographies, SLA literature and reprints will be distributed. Periodicals, government publications, new technical books and ASM and SLA publications will be on display.

Mrs. Margaret H. Fuller, Librarian of American Iron & Steel Institute, New York City, and Chairman of the Metals Division, SLA, has arranged a three day program for the fall meeting of the Division. This will include guided tours of plants and libraries, including the new research library in the Purdue Extension Building, Hammond, Indiana.

ARCAIR TORCH
"saves labor and operating expense" in gouging out casting errors...

"Operators prefer the Arcair Torch because it is lighter, faster and not as 'hot' to operate", says the cleaning and welding shop foreman of a midwestern foundry.

This foundry produces nominal alloy gear blanks for use in heavy duty trucks. Such casting operations often necessitate a certain amount of gouging to remove cracks, errors and other defects from the castings.

On production-line jobs like this, simplicity, ease of operation, economical performance and smooth, even cuts are essential. The Arcair Torch, using only carbon arc and compressed air, fits these requirements better than other gouging, cutting or chipping methods.

For almost two years this foundry has been using six Arcair Torches. Says the foreman, ". . . now the men will not operate without them."

Write for free bulletin with facts and photographs of time and money-saving applications of the Arcair Torch. **Arcair Company**: EASTERN DIVISION, P. O. Box 337, Lancaster, Ohio; WESTERN DIVISION, P. O. Box 4227, Bremerton, Wash.

Arcair TORCH

Cuts all metals using only electric arc and compressed air

Circle No. 84 on Reader Service Card.

Quality Engineered Spot Welders

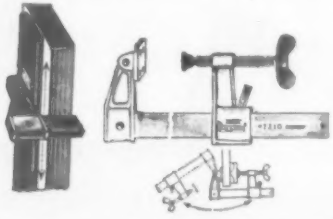
A new line of standard rocker arm spot welders recently announced by Eisler Engineering Co. is described as one

of the most efficient now on the market. Custom built of rugged construction these machines are said to provide low cost, high quality operation from 20 to 50 KVA. Throat depth is adjustable from 12 to 24 inches. Air operated solenoid valve, activated by an electric switch practically eliminates operator fatigue. Cabinet construction makes all inside parts easily available for service or adjustment.

Circle No. 158 on Reader Service Card.

Practical Welding Clamps

A novel and practical accessory which

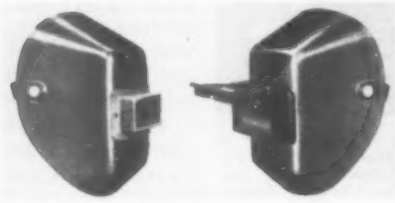


is said to extend the usefulness of new type clamps was announced by Adjustable Clamp Co. "Jorgensen" hinged clamps can swing in an arc of nearly 180 degrees up to, or away from the work. The new accessory is in the form of track; with the track mounted wherever desired, the swivel-foot of the clamp is inserted in the track, and the clamp then becomes adjustable sideways.

Circle No. 159 on Reader Service Card.

Comfortable Welding Helmets

These new fiber-glass welding helmets, made in a fixed-front and a lift-front type, feature the narrow front



shape popular with many operators according to Jackson Products, Inc. Said to be resistant to heat and moisture, these helmets withstand weld spatter, hold their shape and outlast other helmet types.

Circle No. 1 on Reader Service Card.

Fibre-Glass Welder Cabinet

An A.C. arc welder, featuring a non-conductive Fibre-Glass welding cabinet

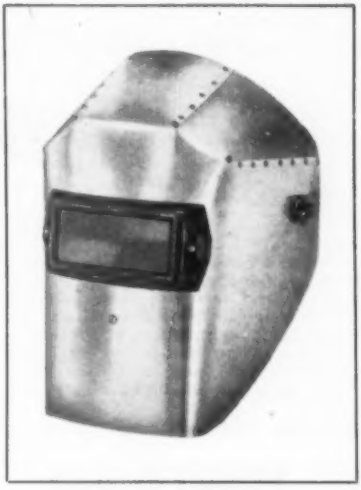
that is said to be the first of its kind, has been introduced by Marquette Mfg. Co., Inc. With this welding cabinet construction, "Perma-Shield," it is claimed that losses from "eddy currents" and hysteresis are solved. According to the manufacturer, this new fibre-glass welder cabinet gives the advantages of a non-conductive, tough, lightweight material that is noiseless, weather-proof, corrosion-resistant, rust-proof and permanently colored. Four models are available in welding current ranges from 25 to 275 amps.

Circle No. 160 on Reader Service Card.

Sensational NEW Aluminum Welding Helmet

sellstrom

No. 206 Helmet Keeps Welder "Cool as a Cucumber"



The fibre helmet will now have to make room for a newcomer—the Aluminum Helmet—which can well take first place in helmet preference among welders everywhere.

1. Sheet aluminum, laminated to a formed fibre base, becomes a positive heat reflector. It throws back the heat, keeps the welder's face "cool as a cucumber".

2. Consider these comparison tests made by a recognized testing laboratory. The heat source was two inches from the helmet.

   a) At 295 degrees Fahrenheit outside the helmet the uncoated fibre helmet registered 201 degrees inside the helmet but the aluminum helmet registered only 107 degrees inside.

   b) At 400 degrees Fahrenheit outside the helmet the uncoated fibre helmet burst, shattered, fell apart, but the aluminum helmet, after ten minutes of this intense heat, registered only 141 degrees inside.

3. This helmet costs no more than a good fibre helmet. Your choice of Standard or Sel-O-Matic headgear and either the front loading or "Lift Front" plate holder. Headgears and plate holders are interchangeable.

This aluminum helmet will soon be available at all Sellstrom dealers. In the meantime, see it at our BOOTH 31 AT THE CHICAGO NATIONAL SAFETY SHOW or write us for the complete details.

sellstrom

MANUFACTURING COMPANY

228 Hicks Road Palatine, Ill.

Eye and Face Safeguards Designed for Utmost Comfort

Circle No. 85 on Reader Service Card.

Electrode Holder Has Glass Fiber Handle

A molded glass fiber handle is one of the key features of the 14-ounce, 300

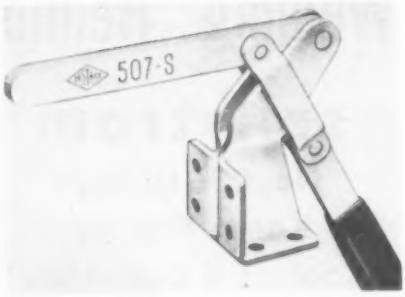
amp Caddy Cub electrode holder made by Erico Products, Inc. The glass fiber gives a handle that has high tensile strength and is impervious to moisture, arc radiation and mechanical abuse. Reduced hand contact area affords cooler operation. The holder operates continuous-duty 1/16 and 3/16-inch diameter electrodes and ¼-inch electrodes intermittently.

Circle No. 161 on Reader Service Card.

CIRCLE NUMBERS ON THE CARD AND MAIL!

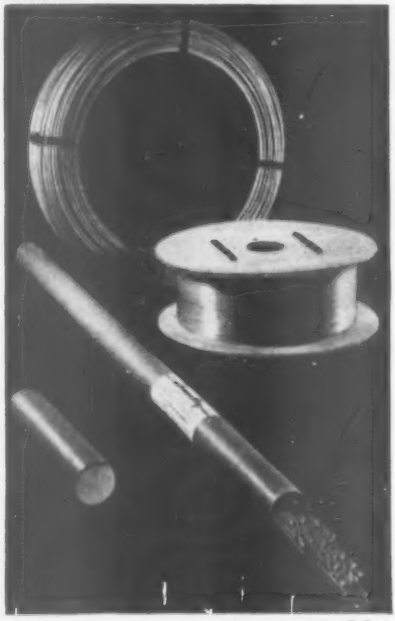
Handy Welding Clamp

"Low silhouette" and "complete clearance" are the two big features of the new toggle clamps which have just been



brought out by Detroit Stamping Co. Specially designed to "hug the fixture" and with a "flop-over action" which flicks the spindle and holding bar completely away from the working surface. Complete clearance makes it ideal wherever sheets of metal or plastic are positioned for light-duty processing.

Circle No. 70 on Reader Service Card.



FOR QUALITY WELDMENTS USE
***Drawalloy* CORPORATION**
QUALITY CONTROLLED
STAINLESS STEEL
Welding Wire

- **available in Spools, Coils and Lengths**
- **for Automatic and Semi-Automatic gas and inert arc welding**

Welding wire by Drawalloy is made to an exacting high standard... a high standard established by long-experienced welding men who know welding wire and how it must work. Set-ups for automatic and semi-automatic welding take more time than regular welding. That's why you want to be sure of satisfaction before you start. This *reliable* wire is weld-tested to give the best results every time. Write today for complete information and prices.

WELDING SUPPLY DISTRIBUTORS: Get prompt delivery on all sizes and grades of stainless and tool steel wire for gas and inert arc welding.

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CORPORATION
Lincoln Highway at Alley Street • York 11, Pennsylvania

Circle No. 86 on Reader Service Card.

Portable Oxy-Acetylene Unit for Aluminum Welding

A compact, portable oxy-acetylene welding unit for use on all commercial aluminum alloys has been developed by Harvey Aluminum in conjunction with Burdett Oxygen Co. Designed originally for Harvey's field engineers, the Burdett welding assembly consists of a full 80 cubic foot oxygen cylinder, a full B

acetylene cylinder, and accessory group consisting of torch and tips, regulators, twin hose, goggles, wrench and file lighter. Additional equipment, such as cutting attachments, portable cylinder carts and larger cylinders are optional. Total combined weight is 125 pounds.

Circle No. 162 on Reader Service Card.

Improved Paste Solder

An improved solder in paste form has been made possible by recent development of a flux which permits solder to be held in suspension permanently without inclusion of binder of thickening agent. Increased fluxing activity that eliminates the need for pre-cleaning enables the paste to wet all metals except aluminum. Called Tinol, the product has been introduced by American Solder & Flux Co.

Circle No. 163 on Reader Service Card.

Improve

Positioning and Lifting Efficiency . . .

at low cost!

Safely lift and position weldments of all types and sizes. Rugged, lightweight Gonser Positioners provide versatile low cost handling.

Heavy 8" weldment easily lifted and positioned with this unit.

The most economical welding positioner ever developed. Safely, easily and quickly handles and positions plate and shapes of all kinds.

This unit easily lifts and positions fabricated steel up to 2" thick.

Other standard and special positioning and lifting devices available for handling weldments, castings, etc. of all sizes, shapes and forms.

FREE! Write for complete details of many exclusive features.

GONSER Portable Positioners

Manufactured by James Campbell Smith, Inc.
P. O. Box 64 • Willoughby, Ohio

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NO MATTER WHAT METALS...

there's a GB silver brazing alloy and flux combination that will *Speed Your Production!*

SILVER
COPPER
BRASS
STAINLESS STEEL
BRONZE
STEEL
NICKEL
CHROME ALLOYS
GOLD
TOOL STEEL
CARBIDE
INCONEL
ETC

Every day more and more fabricators are learning that GB Silver Solder with GB Flux makes an unbeatable production team for low temperature brazing.

From the GB line of six standard silver solders you can select the one which will fully meet your production specifications. Yes, with GB Silver Solders you get sound, low-cost joints on virtually any ferrous or non-ferrous metal.

GB Standard Silver Solders:

GB No. 50 Silver Solder, melting range 1160-1175°F
GB No. 50N Silver Solder, melting range 1240-1260°F
GB No. 45 Silver Solder, melting range 1125-1145°F
GB No. 41 Silver Solder, melting range 1125-1160°F
GB No. 35 Silver Solder, melting range 1130-1270°F
GB No. 31 Silver Solder, melting range 1130-1300°F

For special jobs where special silver solders are required, GB offers you competent technical assistance, backed by over 80 years of experience in alloying and refining precious metals.

GB FLUXES

The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.

GB DATA BOOK

Here's real factual data on all of the important phases of low temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.

GOLDSMITH BROS. SMELTING AND REFINING CO.
1304 W. 59th Street, Chicago 36, Illinois
Suppliers of Precious Metals to Industry Since 1867

Circle No. 88 on Reader Service Card.

300 Amp. Rectifier Welder

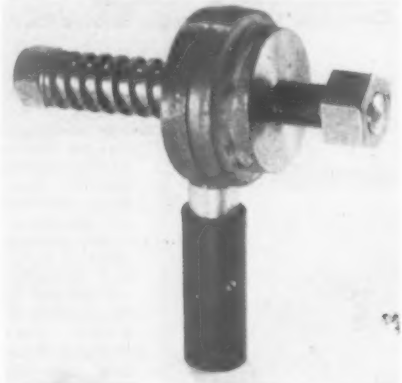
A new 300 amp rectifier welder featuring quiet operation and low maintenance cost has been announced by the General

Electric Co. Now in production at the welding department's new plant at York, Pa., the welder offers a full current range of 20 to 375 amperes. The new welder utilizes the moving primary coil design, obtaining current adjustments by separation of primary and secondary coils. Windings are aluminum and silicone insulation is used on all coils.

Circle No. 22 on Reader Service Card.

500 Amp Rotating Ground

A 500 amp rotating ground attachment has been developed by Wagner Manufacturing Co. to meet the need for trouble-free transfer of welding current to rotating work. Units are simply



bolted to the work or fixtures and are easily joined to welding cable by simple, efficient cable connectors.

Simple in construction, the sturdily-built attachment uses spring-loaded copper contact plates. Field tested, the unit has proven satisfactory for use with current up to 700 amps.

Circle No. 165 on Reader Service Card.

Multi-Purpose Flux

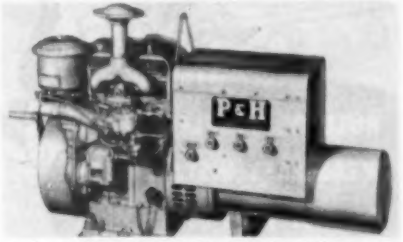
A multi-purpose flux for brazing and welding cast iron and brazing copper, brass, steel and malleable iron has been introduced by Northeast Metals Co.

Called Nemco, the new flux is to be used without surface cleaning, offering quicker tinning over a wide range of temperatures through rust, scale or dirt. The flux is said to give cleaner, stronger brazed and welded joints.

Circle No. 95 on Reader Service Card.

Latest Gas Driven Welder

Of entirely new design, the lightweight gasoline engine welder combining extremely small, compact size with generous output, was announced by Harnischfeger Corp. Power is supplied by a two-cylinder, variable-speed, air-cooled engine close coupled to the welding gen-



erator. Capacity and weight of the portable welder are 20 to 200 amperes and 425 pounds respectively.

Circle No. 166 on Reader Service Card.

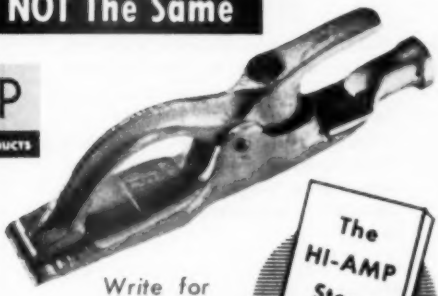
Improved Welding Helmet

Kedman Company has recently improved their Huntsman Helmet by incorporating a new pure rubber block which replaces former spring-loaded swivel on which headgear inside helmet turns. The new rubber pressure block is said to give increased service life and outlast many springs.

Circle No. 107 on Reader Service Card.

All Ground Clamps are NOT The Same

NEW **HI-AMP**
WAGNER WELDING PRODUCTS



500 Amp Ground Clamp

Powerful spring — completely enclosed—cannot be knocked out or shorted out.

• Easy Tension adjustment • • Powerful Contact • Special Copper Alloy • • Broad Flat Base.

More rugged, better engineered and more efficient than any other such clamp on the market.

SOLD ONLY THRU QUALIFIED WELDING SUPPLY DISTRIBUTORS.

Write for ***FREE*** *interesting data on reasons why Hi-Amp products are better.*

Weld with Wagner

WAGNER MANUFACTURING COMPANY
350 W. ADAMS ST. JACKSON, MISSOURI

Circle No. 89 on Reader Service Card.

For *any* application—channel, angle iron, wood or tubular steel tongue—there's a tough, durable BULLDOG Coupler for a fast fit! Light boat rigs or heavy industrial trailers, there's "no hitch" to installing a BULLDOG!

- **Crafted in true Hammer Blow tradition—as old as the trailer industry!**
- **¾ of socket is a single steel drop-forging for maximum strength!**
- **Socket rests on the ball while hitching trailer—no slippage!**
- **Precision engineered and machined to close tolerance—clean design!**

Model 2-B, illustrated, for heavy-duty trailers up to 8000 lbs.; has a tubular steel shank 2¼" O.D. by 1⅞" I.D. by 5" long. List price, complete with 2" ball, $8.48 Fed. Tax included, F.O.B. Wausau, Wis. Models from 2500 to 20,000 lb. capacity. We manufacture a complete line of *Safety-Engineered* trailer parts; write today for free Brochure 18-J

HAMMER BLOW TOOL COMPANY
"As old as the Industry!"
WAUSAU, WISCONSIN

Circle No. 90 on Reader Service Card.

Rubber Tired Turning Rolls

A new line of rubber tired turning rolls with capacities from 5000 to 100,000 lbs. per unit, has been introduced by

Aronson Machine Co. Turning speeds from zero to 80 ipm in the 5000 lb. class and zero to 38 ipm in the 100,000 pound rolls are provided by compact transmission which has micrometer dial control. Safe diameter range of the rolls is 8-inch minimum up to a maximum of 16-feet. Magnetic braking is standard equipment in all models above the 10,000 lb. class.

Circle No. 11 on Reader Service Card.

Portable Spot Welder

Entirely different in design, the new line of portable spot welders have exceptionally high spring pressure which

is readily adjustable to suit different conditions. A variety of air and water cooled models either with automatic timer or built-in tripswitch is available from Aro Spot Welders.

Circle No. 168 on Reader Service Card.

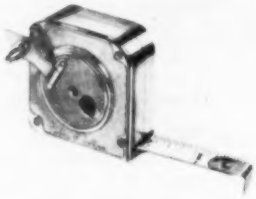
Efficient Welding Clamp

Equipped with an adjustable bolt retainer and solid steel base, new toggle action table clamp is a recent addition to The Robert J. Kelly Mfg. Co. line of fast grip toggle clamps. Added feature of the novel bolt retainer provides for infinite angular adjustment of the pressure foot assembly from zero to 90° to aid clamping on flat or inclined work.

Circle No. 169 on Reader Service Card.

Steel Tape Rule

A steel tape rule, the new Super Chief, is 16 feet long and has increased strength and rigidity for easier, more convenient inside and outside measuring. Made by Carlson & Sullivan, Inc., the rule has a



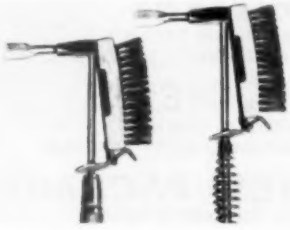
¾-inch wide white blade. A handy rewind crank moves blade in and out of the case, without backlash, to protect it from welding torches, etc.

Circle No. 170 on Reader Service Card.

CIRCLE NUMBERS ON THE CARD AND MAIL!

Weld Chipping Hammer

Recently redesigned, the "Dual-Tool" weld chipping and cleaning hammer



marketed by Atlas Welding Accessories Co. now has replaceable bits; either cone or chisel. The chisel bit can be inserted straight or as a cross chisel. When worn out, it can be drifted out and replaced with a new bit of chisel steel. The tool is available with either wood or metal handle.

Circle No. 171 on Reader Service Card.

Magnetic Hardfacing Fluxes

Designed for build-up and hard facing Magnecote magnetic alloy fluxes offer improved operation with all semi-automatic welders. Recently added to the Stoody Co. line are Magnecote 304 for build-up of carbon steel and Magnecote 305 for use on equipment subjected to both abrasion and impact. Magnecote fluxes are also available for use on manganese steels.

Circle No. 172 on Reader Service Card.

JUST LIKE THE **NEW**

cam-lok

"QUICK-DISCONNECT"

ELECTRODE HOLDERS

CHECK THESE FEATURES:

- ★ Eliminates need for carrying whips.
- ★ Holder plugs in quickly and easily to any cable merely by attaching holder handle to cable end.
- ★ Less money tied up in cables.
- ★ No electrician and no tools required to change holders.
- ★ Complete holder body and jaws insulated with tough, heat-resistant fibre glass.
- ★ High pressure positive lock—perfect conductivity.
- ★ Offset jaws permit infinite variety of electrode positions without rod-bending.
- ★ Offset holder keeps welder's hands farther from arc.
- ★ Offset holder permits burning rods to shorter stubs. Result—substantial savings.
- ★ Choice of offset or straight jaws.

Send TODAY for Bulletin No. 121

cam-lok

DIVISION OF EMPIRE PRODUCTS, INC.

P. O. Box L-98, Cincinnati 36, O.

See us in Booth No. 1056 at the National Metal Exposition, Chicago.

Circle No. 91 on Reader Service Card.

Universal Grinder Attachment

Design for heavy-duty production grinding, as well as for intermittent

light polishing jobs which call for frequent setup changes, a new, low cost, attachment for all types of wall, bench and floor, coated abrasive backstand grinding and polishing operations, is announced by Coated Products Division of The Carborundum Company. The new backstand idler permits belts of the same length to be used with contact wheels of various diameters. A tracking device eliminates the need for precise center alignment between idler pulley and contact wheel, thus minimizing downtime during contact wheel change-overs.

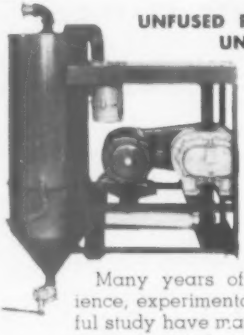
Circle No. 173 on Reader Service Card.

Aluminum Welding Wire

A new high quality welding electrode for inert arc welding of aluminum has been developed by Aluminum Company of America. The new consumable electrode was produced to achieve weld soundness as required in Navy specifi-

ARCO WAND

UNFUSED FLUX RECOVERY UNITS . . .



- *Save Time and Materials*
- *Cut Costs*
- *Increase Production*

Many years of valuable experience, experimental work and careful study have made ArcoWand the most practical and efficient units on the market.

Engineered for top performance, units are easily adaptable to any combination of layout or capacity.

FREE: We would like to send you this booklet which shows how these carefully designed units increase efficiency and improve quality.

American VACUUM CO.

818 S. Michigan Ave., Chicago 5, Ill.

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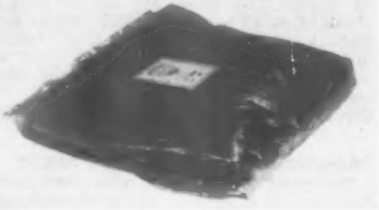
BRAZILIAN DEERSKIN AND COWHIDE LEATHER

GARMENTS

WELDERS COWHIDE BROWN QUALITY LEATHER

NEW PACKAGE

ALL GARMENTS NOW PACKED IN VISUAL BAGS



SOLD BY DEALERS ONLY — If your Dealer cannot supply you write us for complete details about availablity.

John Tillman & Co.

1561 W. 19th St. Long Beach, Calif.

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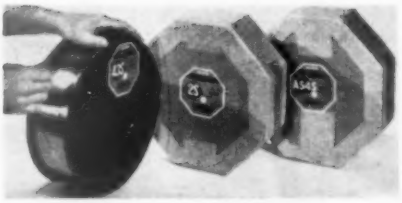

cations. Each lot of the product, called Alcoa I.G. (inert gas) welding electrode, is said to be carefully tested by welding in the overhead position. It was designed to be used in semi-automatic inert-arc welding guns although it can also be used for tungsten inert-arc welding.

Circle No. 49 on Reader Service Card.

Rocker Arm Spot Welders

New type RA rocker arm spot welders marketed by Federal Machine and Welder Co. are engineered for high protection with a minimum of operating and maintenance costs. Unitized design and construction is used throughout for rapid and easy maintenance and interchangeability.

Circle No. 175 on Reader Service Card.

Circle No. 94 on Reader Service Card.

Reduce Spot-Welding Rejects With

DICE MICROHM METER MODEL 151

First developed by Dice, this instrument is now widely used in industry to maintain quality control and reduce rejects in the spot-welding of aluminum . . . by checking the surface resistance of sheets to see that they have been properly cleaned. The Dice Model 151-S measures resistances as low as ½ microhm in the low range to 750,000 microhms in the highest range. A low resistance reading indicates that the metal to be welded is properly cleaned. For free bulletin giving detailed information on how the Dice Microhm Meter can help you, write today.

J. W. DICE CO.
Englewood 1, New Jersey
"Non-destructive Testing and Measuring Instruments"

NEMCO ALL PURPOSE Cast Iron FLUX

Cast Iron Welding and Brazing is easy with this new multi-purpose flux. Quickly fins and deeply penetrates even through rust, scale or dirt. Good for brazing steel and copper. Reduces torch time.

If your dealer cannot supply you, send us his name and address. A FREE SAMPLE will be sent you.

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NORTHEAST METALS CO.
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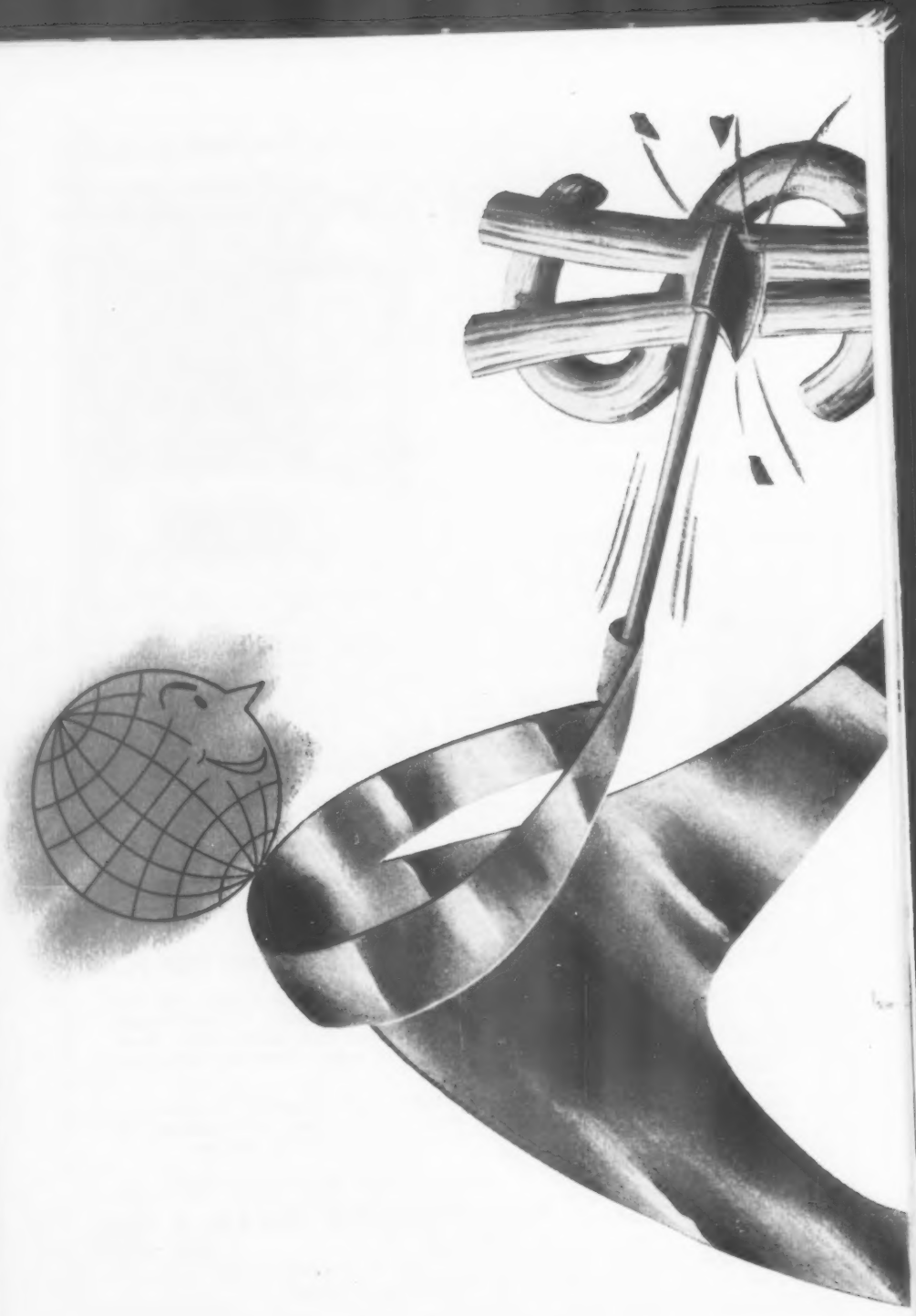

At the '54 Metal Exposition—Nov. 1-5 . . .

50,000-PLUS METALS INDUSTRIES MEN

WILL LEARN NEW WAYS OF CUTTING COSTS!

Your competitors . . . thousands of 'em . . . will be on hand at this great industrial event to check closely on everything that's new and improved . . . everything that will help them build better products . . . cheaper . . . faster!

They'll come from all corners of the land . . . these 50,000-plus metals industries men . . . and they'll take away with them, when this great Metal Show ends, more ideas . . . more information and more know-how than any 'stay-at-home' executive could possibly match!

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INTERNATIONAL AMPHITHEATRE
CHICAGO NOV. 1-5

NATIONAL METAL EXPOSITION

NATIONAL METAL CONGRESS

NEWS of the WELDING INDUSTRY

Coughlin Joins Eutectic

J. P. Coughlin, former Manager of the Arc Welding Division of Westinghouse Electric Co. in Buffalo, has joined Eutectic Welding Alloys Corp. as Assistant to the President and will take up his

duties early this month. The announcement was made by Rene D. Wasserman, president.

Mr. Coughlin is well known in the welding industry through his association with the Westinghouse Company during the past 15 years where he was in charge of welding, sales-engineering and production.

Mr. Coughlin's first assignment is to collaborate with Eutectic's sales group toward strengthening and increasing the company's distributor organization.

Appoint Regional Chairman for 6 N.W.S.A. Zones

To make it easier for members of the National Welding Supply Association in established trading areas or in several adjoining states to meet more frequently, each Zone of the N.W.S.A. has been divided into two or more regions. These regions are headed by Regional Chairmen who will hold regional meetings and report to the Vice Presidents in charge of the various Zones.

A complete listing of Zones, vice presidents in charge of each, and regional chairmen can be had by writing Robert C. Fernley, secretary-treasurer, National Welding Supply Association, 1900 Arch St., Philadelphia 3, Penna.

Tweco Appoints Boring Eastern District Manager

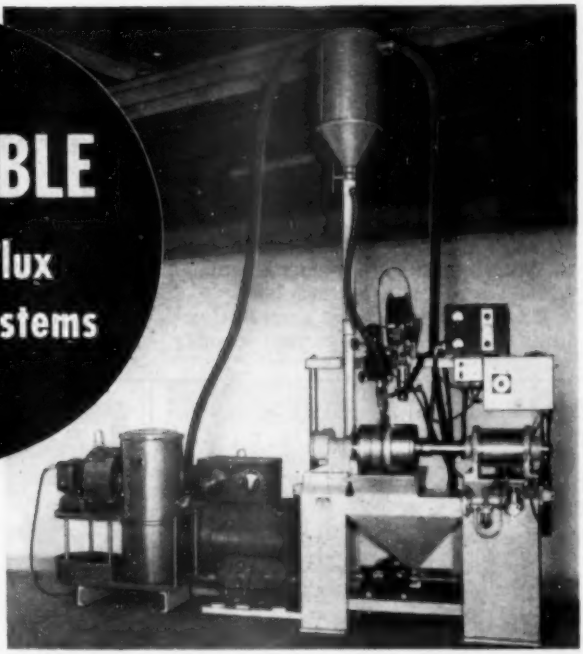
Tweco Products Co. has announced the appointment of Donn

Boring as Eastern District Manager. Mr. Boring will be responsible for sale of Tweco products in 14 eastern states and will make his home in Roseland, New Jersey.

Mr. Boring has been with Tweco since June, 1952. Prior to that time, he was active in the Canadian welding industry for more than 15 years.

INVINCIBLE

Welding Flux Recovery Systems



This compact set-up includes a primary separator tank and an Invincible Model 460 unit.

Pay for themselves . . . with interest !

If you have a submerged arc welding job, consider these benefits:

1. Invincibles save valuable flux by recovering **all** unfused flux from the work, removing slag or fused particles, and returning the unfused flux to the hopper of the welder. Both manual and continuous flow systems are available.

2. Invincibles save costly man-hours because they are more rapid and efficient than manual methods.

3. Invincibles also save money by removing all fine dust (flux flour), thus speeding production and reducing welding rejects.

These Invincible advantages can be applied to your job, regardless of its size. Let us send you our **Free Folder** on Flux Recovery.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

Circle No. 96 on Reader Service Card.

Feature Titanium Welding at Boston Clinic

Latest techniques for welding titanium and other alloys will be exhibited at the Producers' Welding Show, October 13-15, at Cambridge, Mass., offices of Whitehead Metal Products Co., Inc.

The three-day clinic will include demonstrations on metal samples, motion pictures and question and answer sessions by welding consultants from leading producers.

Demonstrations will cover titanium, aluminum, brass and copper alloys, stainless steels, Monel, nickel, Inconel and plastic pipe.

Rejoins Adams Hard-Facing Co.

C. E. Adams, sales manager of the Alloy Rod and Metal Division, Victor Equipment Co., has announced his resignation from that position. Mr. Adams is rejoining Adams Hard-Facing Co., Wakita, Okla., as vice president and director.

WHEN YOU WELD CAST IRON SELECT THE CORRECT

Fuse-Well

CAST IRON WELDING RODS OR ELECTRODES

FUSE-WELL NO. 11

FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

FUSE-WELL NO. 14 MOLY

FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

FUSE-WELL NO. 22

FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

Sold through Leading Distributors

THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

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SILVER BRAZING ALLOYS

Rings, Stamped or Coined Washers, and Wire Forms

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STEEL SALES

3348 South Pulaski Road · Chicago 23, Illinois
Plants: Detroit, St. Louis, Milwaukee, Minneapolis, Indianapolis • *Offices:* Kansas City, Grand Rapids

Circle No. 98 on Reader Service Card.

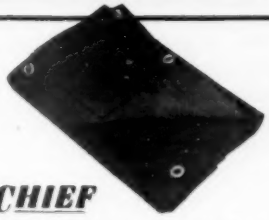
Open X-Ray Office in Chicago, Illinois

The Research & Control Instruments Division, North American Philips Co., Inc., Mount Vernon, N.Y., has announced the opening of a new regional office at 4959 West Diversey Avenue, Chicago 39, Illinois. John C. Washburn is manager of the new headquarters which serves Illinois, Iowa, Missouri, Kansas, Nebraska and parts of Indiana.

New Expansion at Victor Equipment

Victor Equipment Co. has purchased a six-acre site in Whittier, Calif., for expansion of its Alloy Rod and Metal Division. Construction has started on a 6,000 square foot plant for manufacture of hard facing alloy rods. Another 15,000 square foot building will be erected when initial construction is finished in October, according to Jack Spence, vice president in charge of the Division.

REEVES
REG. U.S. PAT. OFF.



FIRE-CHIEF
Treated Welding Curtains
CONFINE YOUR DANGER

A close woven canvas, weighing 10 ounces per square yard before treatment, impregnated with Hooper's Fire Chief treatment under their patent which carries the Underwriters Laboratory seal.

"IF IT'S MADE OF CANVAS, WE MAKE IT"

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FOR BETTER
Quality
Welding
USE A . . .

COLUMBIA TONG TEST
AC-DC AMMETER

Yes — there's an easy, quick way to measure actual welding current. Simply clamp the Tong Test Ammeter around the electrode cable. Instantly you get an accurate ampere reading, without breaking the circuit.

Tong Test is the only clamp-type instrument that can be used on both AC and DC. It is safe, convenient and light in weight.

Assure good welding quality by controlling your amperage. Tong Test is low in cost and will be a profitable investment in preventing costly defects and rejects. Four types with interchangeable ranges to 1000 amperes.

Write for Tong Test Bulletin IW-400

COLUMBIA
COLUMBIA ELECTRIC MFG. CO.
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CUTS WELDING COSTS WITH

NO SPAT

Non-Toxic,
Smokeless Welding Fluid

NO SPAT eliminates slow, costly grinding, chipping, cleaning of weldments, keeps welding jigs spatter-free. Suppresses fumes; no carbon monoxide. Prevents rust, conditions metal surfaces for painting. Ready to use. Test NO SPAT now! Write for FREE sample

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There are forty MALL Service Warehouses, coast to coast. Phone or write the one nearest you —or any of the thousands of MALL stocking dealers —or our Chicago home office for a free demonstration without obligation.

THE BIGGEST ASSORTMENT OF POWER TOOLS OFFERED BY ANY MANUFACTURER

The MALL line includes many types and sizes of: Small Electric Drills—Heavy Duty Electric Drills—Portable Electric Saws—Gasoline Chain Saws—Bench Grinders—Electric Chain Saws—Electric Polisher-Sanders—Electric Screwdrivers—Electric Impact Wrenches—Flexible Shaft Machines—Portable Pneumatic Saws—Pneumatic Chain Saws—Pneumatic Grinders—Pneumatic Drills—Pneumatic Polishers—Pneumatic Sanders—Pneumatic Screwdrivers—and MANY OTHERS!

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Please have one of your traveling MALL salesmen call on me when he is in my neighborhood.

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MU-123

Circle No. 102 on Reader Service Card.

National Carbon Appoints New Officers

National Carbon Company, a division of Union Carbide and Carbon Corp., has appointed Arthur C. Bryan, vice president and general manager of Consumer Prod-

Bryan

Feathers

ucts, and William H. Feathers, vice president and general manager of Industrial Products, according to A. S. Johnson, president. It was announced at the same time that Walter A. Steiner has been appointed Vice President in Charge of Development.

Heads Page Steel District Office

Page Steel & Wire Division, of American Chain & Cable Co., has opened a district office at 630 McFarland St., Houston, Texas. J. J. Cassidy, former sales representative for the division in Southwestern territory, has been appointed District Sales Manager. The new Page office will cover Oklahoma, Arkansas, western Louisiana and almost all of Texas.

POSITIONS AVAILABLE

ELECTRODE SALESMEN

Electrode manufacturer requires experienced salesmen for direct and dealer sales in established territories. Our men know of this ad.
Send complete background information to Box 10154, INDUSTRY & WELDING Magazine, 1240 Ontario St., Cleveland 13, Ohio.

MANUFACTURERS REPRESENTATIVE

with following in welding supply trade to represent nationally known Manufacturer of welding accessories with 14 years background of successful development. Proper individual may have two or three other allied lines. Territory open includes Michigan, Ohio, Indiana, Kentucky, Illinois and Wisconsin.
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See Page 16 for easy index to welding products

BETTER WELDS • CLEANER WELDS
STRONGER WELDS

Use Only Those Good
SAFE NON-TOXIC
"ANTI-BORAX" FLUXES

No. 1 Cast Iron Welding Flux.
No. 2 Brazing Flux for Brass, Bronze, etc.
No. 4 "Braz-Cast" Flux for Bronze Welding Cast Iron.
No. 5 Aluminum Flux for Cast Aluminum.
No. 8 Aluminum Flux for Sheet Aluminum.
No. 9 Stainless Steel Welding Flux.
No. 11 Tinning Compound.
No. 15 Welding Flux for Magnesium Alloys.
No. 16 Silver Solder Paste Flux for Silver Brazing.

Manufactured Only By
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Circle No. 104 on Reader Service Card.

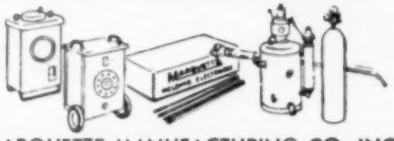
When it Comes to Welding Come to MARQUETTE

For **all** your needs . . . Marquette offers the newest, most **complete** line in the industry today:

Utility AC Welders—2 Models
New "Instant Arc"—the only fully "dead" Cabinet" AC Welders — 4 Models
AND NOW
Heavy Duty Industrial AC Welders—6 Models
Rectifier Type DC Welders—5 Models
Gas Driven AC Welder and Power Plant Combinations—2 Models
Welding electrodes for all applications
Oxy-Acetylene Welding and Cutting apparatus
Welding Accessories, Fluxes and Supplies

Made RIGHT by Marquette to Work BEST for You!

MARQUETTE



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GET THE BEST!
GET **pacific!**

AC and DC, for Stainless Alloys
PHOS BRONZE Electrodes for Bronze and Cast Iron Welding
ALUMINUM Wire and Rod for Aluminum Alloys
INERT GAS Wire for Heli-Arc Welding
SPECIAL ALLOY Rods made to your own specifications — Catalog upon request

UNDERWATER RODS for cutting and welding.

PACIFIC WELDING ALLOYS MFG. CO.
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Circle No. 105 on Reader Service Card.

Deep weld grooves and preheating are not always needed when repairing broken castings. Here's how to . . .

Pneumatic grinder prepares edges of bearing pedestal of steam engine prior to repair.

Repair CAST IRON Parts

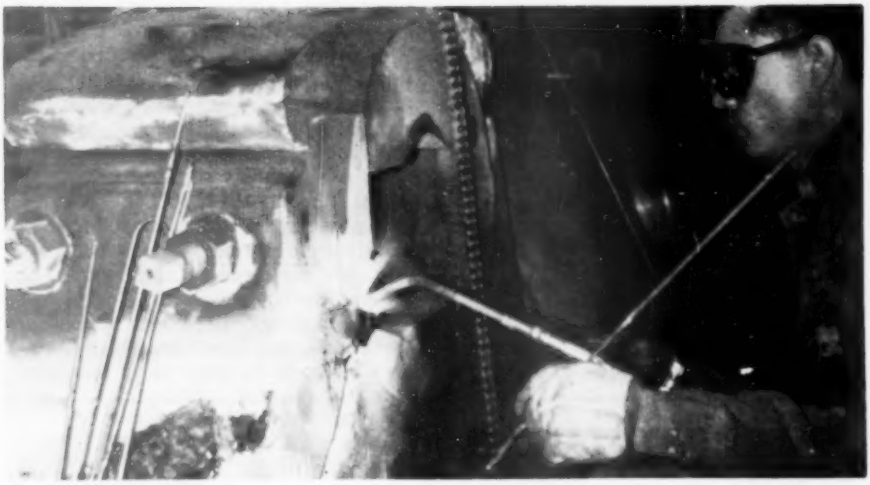
by W. H. Lane, Pres.
Midwest Casting Repair

SPECIALIZING in repair of cracked and broken cast iron, for the past 12 years Midwest Casting Repair has operated on 24-hour call to make large repairs any place in the United States. Every job is done on a contract basis and guarantee on work is equivalent to the guarantee of the original part.

For a repair job, operators take tool boxes which contain welding blowpipes, cutting attachments, hose, regulators, welding rod and pneumatic tools, including chipping hammers, air grinders and air hose. Oxy-arc cutting electrodes work efficiently in some weld preparation and are included in the tool boxes.

On a braze welding job, the customer has little to do in the way of preparation; a minimum of dismantling of machinery is required. If the job requires scaffolding or special housekeeping around the welding area, the customer makes these arrangements.

A great deal of consideration is given to the overall job before a torch is lighted. Special attention is paid to weld preparation. Operators do not always follow the text book when it comes to preparation. For example, most people



Small tack welds are used to keep parts in alignment. After tacking, operator starts at base region and continues toward his tack weld.

With Oxy-Acetylene Welding

believe that a fairly deep groove is correct for cast iron weld repairs. It is also usual practice, on cracks of certain types, to begin welding at the end of the break and weld in the direction of the beginning. These rules are not always followed by Midwest operators.

This company disagrees that the very nature of cast iron requires elaborate pre-heating prior to making repairs of cracks and breaks. They claim to have successfully repaired many castings without use of pre-heating, as it ordinarily is known. By eliminating such pre-heating it has been possible to avoid a great deal of dismantling, costly pre-heating ovens are not needed and distortion, which could require machining, is reduced.

There are several factors that have helped to eliminate pre-heating. First, stresses are controlled by proper welding procedure, care being taken to have as near perfect bond as possible. Operators are trained to spend the necessary amount of time on each square inch of weld so that there is no possibility of a small spot not being properly bonded. Any such small spot in which the bond was missed might well mean a secondary crack

in the base metal. Secondly, long straight stress lines are broken up.

In every welding job, bronze deposit is dressed down by grinding to original surface. This means there is no reinforcing bronze metal on the completed job. In grinding off the excess, we remove a thin surface of bronze deposit which is felt to be brittle and apt to cause trouble in the future. During actual welding, operators only weld short distances that can be easily handled.

The amount of weld metal deposited varies with the size of the part. The average strength of cast iron is not over 20 to 25,000 psi. The bronze, after it has been molten and set, is around 60,000 psi, which means it has three times the strength of cast iron. Based on this fact, it is possible to braze-weld cast iron by putting in bronze equal to one-third of the section being repaired. If a piece of cast iron is welded one-third of the way through, we have as much strength as originally provided.

This balance between deposited metal and cast iron section is based on a close-to-perfect bond between

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MORE COMFORTABLE - -
ANGLE-SHAPED
FOR CLOSE WORK

Specify the complete line of quality-built, guaranteed products.

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WELDING HELMETS, FACE SHIELDS & ACCESSORIES
Kedman Co., 233 So. 5th West, Salt Lake City 1, Utah

Circle No. 107 on Reader Service Card.

bronze and cast iron. It is also based on a purposely enlarged area of bond. This equal strength practice is followed on the theory that cast iron does not have much give —no ductility. If too much weld metal is used, part is likely to develop weaknesses at other points.

From a paper given at the annual meeting of International Acetylene Assoc.

New Approach to Welding Problems

The necessity for discussion, questions and answers and a free exchange of welding information, has induced Eutectic Welding Alloys Corp., Flushing, N. Y., to engage a large suite in the Sherman Hotel, Chicago, during the Metal Show for this one purpose. This novel approach will give visitors a chance to discuss their production and maintenance operations with experts in the metal joining field.

The suite will be open from 1 p.m. until midnight each day of the show except Friday when it will open from 10 a.m. to 3 p.m.

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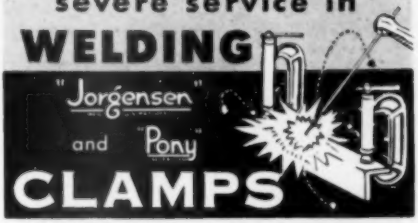
practical for severe service in **WELDING**

"Jorgensen" and "Pony" **CLAMPS**



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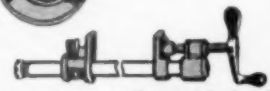
Furnished with All Steel Shield, protecting screw threads from spatter, dirt, heat, rough usage. Cost no more. Last longer.



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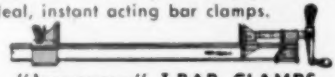

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Strongest, for hard welding service. Instantly adjusted for faster operation. A real improvement over older types.

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Designed to give long-lasting protection.

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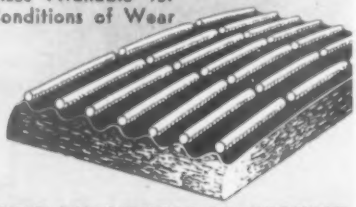

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California Welding Supply Holds Open House

A new store and warehouse for California Welding Supply Co., Stockton, Calif., were unveiled at a recent open house. The new store and warehouse are said to be the most modern and complete welding supply distribution facility in northern California, according to "Doc" Raymond, general manager.

Established in 1950, the firm serves industry and agriculture in San Joaquin and adjoining counties.

Weldrod Co. Starts Operations

Weldrod Company, Meadowbrook (Philadelphia Area), Pennsylvania, announces the start of operations specializing in the man-

NO JOB TOO TOUGH FOR - - -

JOHNSON'S New all-purpose BRAZING FLUX!

Here's the Flux for those really TOUGH jobs in your shop. JOHNSON'S NEW ALL-PURPOSE BRAZING FLUX cleans metal all around . . . does an amazing job of dissolving oxides of burned and dirty metals . . . yet DOESN'T BURN OUT! JOHNSON'S NEW ALL-PURPOSE BRAZING FLUX does a faster job at lower cost.

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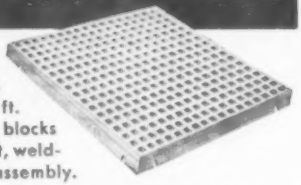

Use these 5 ft. by 5 ft. cast steel blocks for layout, welding and assembly.

Write today for information.

ACORN IRON AND SUPPLY CO.

Delaware Ave. and Poplar St. Philadelphia 23, Penna.

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ufacture of Microspooled (precision layer-level wound) inert gas wire. As originators of the microspooling process, the company believes new economies can now be afforded to the industrial consumer.

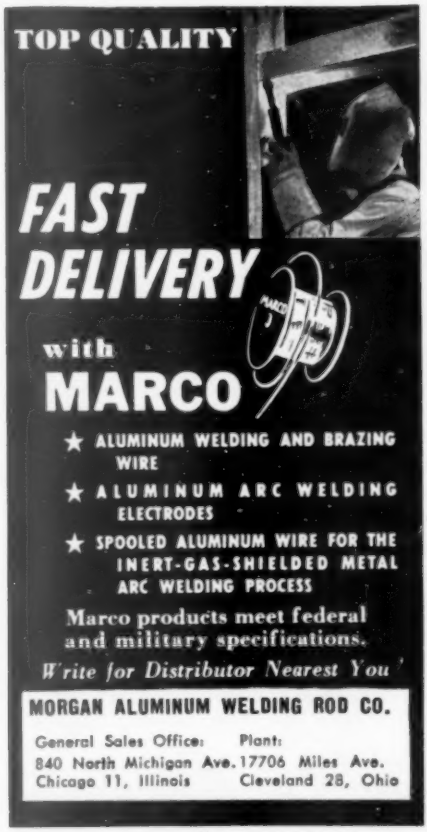
Also available is Weldrod's new and original line of Micro Extruded coated arc welding electrodes and cutting rods.

SEE PAGE 40 FOR VALUABLE FREE LITERATURE AVAILABLE

NWSA Zone Meetings

Increasing sales and lowering overhead was the theme of recent meeting held last month by Central and Eastern Zones of the National Welding Supply Association in Cleveland, Ohio, and Boston, Mass.

Members and guest heard featured speakers discuss problems peculiar to welding supply distributors including handling of returned merchandise, reduction of slow-paying accounts and allocation of advertising budgets.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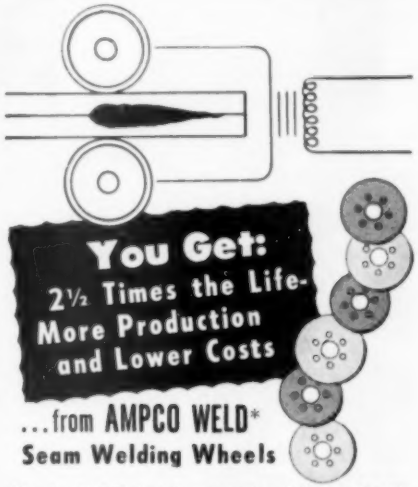

Up to 150% longer service life — that's the report from users of Ampco Weld tube and seam welding wheels. Here's why: Ampco Weld wheels have unusual hardness and toughness at elevated temperatures — exceptional resistance to wear — extra durability — uniformly high electrical conductivity. This adds up to longer runs, fewer shutdowns, increased production, lower costs.

You can get Ampco Weld wheels as rough forgings, finished blanks, or completely machined, as you prefer. Order today — watch production step up, costs step down.

IW-10

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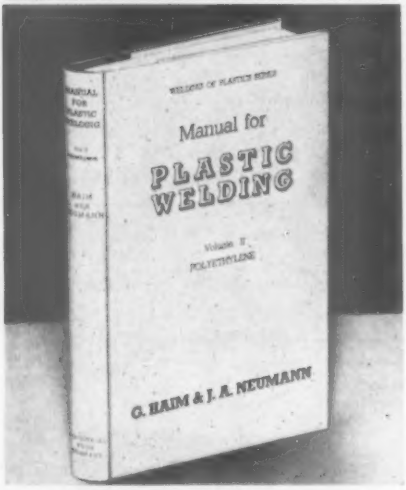
PLASTIC WELDING



VALUABLE NEW DATA

During the last few years gas welding of plastics has been applied with particular success to a large and ever-increasing variety of constructions where it has proved invaluable. Information on this subject is rather scarce. This manual will be extremely valuable to practical welding people and to engineers who intend to incorporate plastic materials into their designs.

PRICE $6.00

Industry & Welding

1240 ONTARIO STREET
CLEVELAND 13, OHIO

900 Attend Welding Show At Virginia Welding Supply

Over 900 guests representing every facet of the welding industry attended a recent welding show held by Virginia Welding Supply Co., Charleston, W. Va. Guests saw representatives of more than a dozen major manufacturers demonstrate a wide range of new or improved welding, brazing and cutting equipment and accessories.

Over 900 guests in only three days was the attendance at a welding show held by Virginia Welding Supply Co.

(EDITOR'S NOTE: To show readers the educational job being done by welding supply distributors, INDUSTRY & WELDING Magazine will present a pictorial feature on this show in the forthcoming November issue.)

G.E. Opens Welding School

General Electric Company's Locomotive and Car Equipment Division is meeting a shortage of welding oper-

ators and supervisors by training them in a company school. The school is open to anyone in the department wishing to learn special welding techniques or to those who want to gain practical welding experience.

New Distributors for Liquid Carbonic

F. H. Lewis, sales manager of the Industrial-Medical Gas Division of Liquid Carbonic Corp., has announced the appointment of the following companies as authorized distributors Liquid Carbonic arc and oxy-acetylene welding equipment:

Chrismer-Hull, Columbus, Ohio; B & B Air Products, Inc., Doyletown Township, Penna.; High Welding Co., Lancaster, Penna.; Triangle Engineering Co., Upland, Penna.; Irish Welding Supply Co., Buffalo, N. Y.; Blackhawk Welding Supply Co., South Beloit, Ill., Lamb Welding Supply Co., Cedar Rapids, Iowa, and The Atlas Company, Cincinnati, Ohio.

HARGRAVE Tested Tools THE CINCINNATI TOOL COMPANY

WELDERS' CLAMPS

THE MOST COMPLETE LINE Individually Power-Tested for Better Performance

WRITE FOR CATALOG
Showing a Clamp for Every Purpose, openings from ¾" to 12" and depths from ½" to 16", also Chisels, Punches, Masonry Drills, Brace Wrenches, Washer Cutters, File Cleaners, etc.

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Are you getting the BIG SQUEEZE?

Is the life being squeezed out of your welding equipment before you've got your money's worth? How long would you like to have your welding torch last? Is a lifetime long enough? Smith's have LIFELONG GUARANTEED equipment!

Write us about it — NOW!

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TOUGHIDE
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EXTRA FLEXIBLE
HIGHEST QUALITY
LOWEST PRICES

#2	$215	#2/0	$388
#1	$256	#3/0	$484
#1/0	$323	#4/0	$603

Cable packed in 250-ft. coils.
Two or more coils shipped prepaid.
Dealer Inquiries Solicited
Write for details.

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Eliminate Dust to Maintain
Cooler Motors • Constant Arc Longer Brush and Rotor Life • Greater Welder Efficiency • Constant Welder Operation • No Shut-downs • Deeper Penetration and Adhesion.

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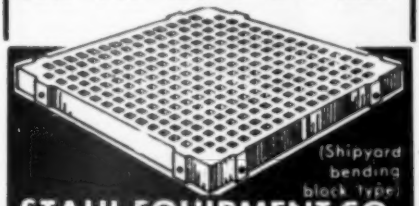
Floor plates — bending tables — layout tables—straightening tables—dog blocks bending blocks—blacksmith blocks. 5'x5' 6'x6' — 6'x8' — 6'x10' — 5'x10' 6'x12'—3'x3'—either 6" or 7" thick.



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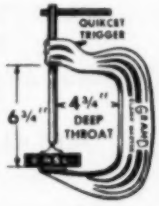
SPEED CLAMPS

A S L SERIES

SAVE MINUTES ON EVERY CLAMPING OPERATION!

Grand Speed Clamps are quick setting and instant releasing—just push down the screw and tighten with a turn on the vise-type handle. Trigger releases work instantly.



Grand Speed Clamps have extra deep throats—are ruggedly built of NACO No. 6 Steel—spatter proofed.
4 Sizes: 2" to 8" Opening

Famous GRAND "C" Clamps

Alloy Steel (Stronger than forged) Spatter-Proofed Swivels, Deep Throat – Replaceable Swivels

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	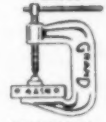	
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Every
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'Red Head'

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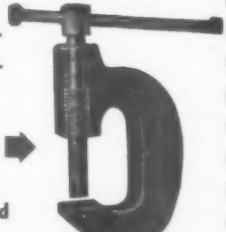
No Threads to Damage



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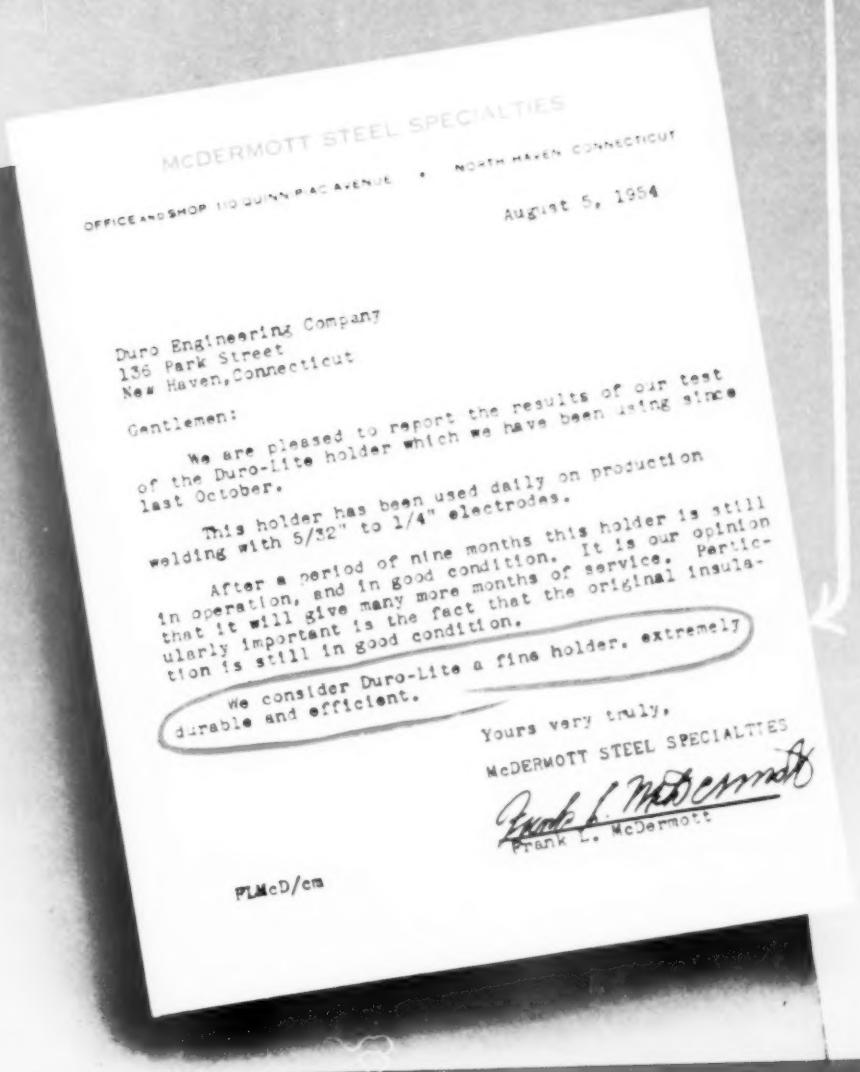

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August 5, 1954

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Yours very truly,

McDERMOTT STEEL SPECIALTIES

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DURO ENGINEERING COMPANY

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HI-AMP GROUND CLAMPS ARE MORE RUGGED, BETTER ENGINEERED AND MORE EFFICIENT.

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